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ABSTRACT

This task-based curriculum guide for industrial electronics is intended to help the teacher develop a classroom management system where students learn by doing. Introductory materials include a Dictionary of Occupational Titles job code and title sheet, a career ladder, a matrix relating duty/task numbers to job titles, and a task list. Each task is then outlined in this format: statement of duty, statement of task, duty and task numbers, a checklist of achievement indicators, a statement of the criteria for achievement of competence, specification of required tools and equipment and resources, and lists of teacher activities and student learning activities. The tasks are categorized by six duties: performing related electronics activities; assembling sub-assemblies and complete units; testing components, assemblies, and systems; servicing components, assemblies, and systems; maintaining hydraulic and pneumatic systems; and using employability skills. Other contents include student and class achievement records, tool/equipment lists, and a resource list. (YLB)

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TRADE & INDUSTRIAL EDUCATION

INTRODUCTION

The Michigan Department of Education, Vocational-Technical Education Service, has adopted descriptions and codes for vocational-technical education programs found in the document entitled, "A Classification of Instructional Programs" (C.I.P.) National Center for Educational Statistics, February, 1981. This new coding system is required of all States in reporting data on all programs receiving funds under P.L. 94-482, the Vocational Education Amendments of 1976.

The United States Office of Education (U.S.O.E.) coding system was discontinued at the conclusion of the 1981-82 school year. The 1982-83 school year was a transition year from the U.S.O.E. code system to the new C.I.P. Code system.

Michigan Secondary Trade and Industrial Education programs/courses are included in the following Classification of Instructional Program (C.I.P.) Codes.

CIP	PROGRAM DESCRIPTOR
46.000	Construction Trades
47.000	Mechanics and Repairers
48.000	Precision Production
49.000	Transportation and Material Moving

NOTE: The Trade and Industrial Education programs/courses codes not found in the above codes, but included under Michigan Trade and Industrial programs/courses are:

CIP	PROGRAM DESCRIPTOR
09.0701	Radio/T.V. General
12.0403	Cosmetology
43.0107	Law Enforcement

This Michigan Trade and Industrial Education Curriculum Guide uses the new C.I.P. program description code(s) and lists the entry level job titles associated with the occupational program area by the Dictionary of Occupational Titles (Fourth Edition, 1977), D.O.T. Code, and the Michigan Occupational Information System, (M.O.I.S.), Numerical Index code. NOTE: This information is located under Job Information with program description(s).

PROGRAM DEFINITIONS/GOALS

Vocational Education

The term "vocational education" means organized educational programs which are directly related to the preparation for paid or unpaid employment or for additional preparation for a career requiring other than a baccalaureate or advanced degree.[1]

Michigan's Major Mission and Goals of Vocational-Technical Education

The delivery system of Vocational-Technical Education in Michigan will be developed around a major mission and four complementary goals.

Mission: Persons of all ages in all Michigan communities will have ready access to high quality vocational and technical education which is realistic in the light of actual or anticipated opportunities for gainful employment and consistent with their needs, interests and abilities.

Goal I: Persons with differing sex, age, racial/ethnic background, socio-economic status, academic disadvantage, economic disadvantage, limited English proficiency, physical and mental capabilities, and geographical location will have access to vocational-technical education and training or

[1]The Education Amendments of 1976, Section 195(1), Public Law 94-482.

retraining and shall not be excluded from such programs because of any distinguishable personal characteristics.

Goal II: All local vocational-technical education programs will be of such quality as to assure that all students are provided learning experiences which are realistic and sufficient in light of their occupational objective.

Goal III: All prevocational/exploration, career guidance and placement programs will be coordinated with local vocational-technical education programs so that each student may make an informed and realistic occupational choice and have access to quality job placement programs.

Goal IV: All local vocational-technical education programs will be planned, monitored, and evaluated in light of actual or anticipated employment opportunities and the demand by students for programs related to their abilities and occupational objectives.

Goal V: Local, public, secondary, and postsecondary educational institutions will be responsive to the economic development and job training/retraining needs of business, industry and labor in their communities.[2]

Trade and Industrial Education

A vocational education curriculum that includes programs for manufacturing, construction, mechanical service, public service, health service, technical, and fisheries occupations, that prepares a person for entry level employment, upgrading or retraining in a semiskilled or skilled trade, semiprofessional or technical occupation, not generally classified

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[2]The Annual and Long Range State Plan for Vocational Education in Michigan 1984-87.

as Agriculture, Distributive, Business or Office, in the Health profession, or Consumer/Home Economics in nature.

NOTE: The occupational clusters found within the scope of trade and industrial education include skilled or semiskilled trade, craft, or occupations which directly relate to the designing, producing, processing, assembling, maintaining, servicing, or repairing of any manufactured product.

TRADE AND INDUSTRIAL EDUCATION STUDENT ORGANIZATION

VICA

The Vocational Industrial Clubs of America (VICA) is the national organization serving trade, industrial, technical, and health occupations students in the United States. VICA incorporates leadership, citizenship, and character development programs and activities into the skill training offered in America's schools and taught by men and women who have worked in the occupational areas in which they now instruct their students.

VICA emphasizes respect for the dignity of work, high standards in trade ethics, workmanship, scholarship, and safety. VICA promotes understanding of the free enterprise system and encourages development of patriotism through the practice of democracy within the club.

Competitive activities in the trade skills as well as areas such as public speaking, job interview, parliamentary procedure and safety are vital aspects of VICA's program.

TRADE AND INDUSTRIAL EDUCATION CURRICULUM GUIDE

This Michigan Trade and Industrial Education Curriculum Guide is the result of a project funded by the Michigan State Board of Education and the Michigan Department of Education. Vocational-Technical Education Service. The project is located at Michigan State University in the Department of

Agricultural and Extension Education (AEE), College of Agriculture and Natural Resources and is known as the Curriculum Resource Team.

The project is directed by Dr. Chris M. Olson and Ms. Carol E. Culpepper, Faculty Specialist, Curriculum Resource Team Coordinators. They were responsible for developing the curriculum format and working with a task force leader and committee of individuals from business, industry, and education to ensure the quality of the curriculum. The development of this curriculum was monitored by Melvin France, Secondary Trade and Industrial Education Supervisor.

The names of the occupational task force leader(s) committee members, secretaries, and other support staff are acknowledged after this Introduction.

The occupational program area(s) selected for curriculum development are based on a Vocational-Technical Education Service prioritized program ranking based on employment demand, State average percent of placement, reimbursed enrollments, the number of programs, and entry level wages within the State of Michigan.

This curriculum guide was developed from the results of a statewide survey and job analysis of incumbent workers in the related occupational areas.

The curriculum guide is representative of the occupational job duty categories which list major activities and tasks performed on an entry level job. The curriculum guide contains a resource list and criteria statements which indicate the minimum standards of performance accepted as evidence of competence in completion of the task by business and industry. This is a task-based curriculum guide which helps a teacher develop a classroom management system where students learn by doing. It is based on task analysis and reflects the skills, knowledge, and attitudes that employers expect incumbent workers to possess.

The curriculum is linked to the labor market, helps the instructor open communication channels with business and industry, and manage classroom instruction where students learn "Need-to-Know" instead of "Nice-to-Know" facts.

This curriculum is adaptable for special needs/handicapped students, helps to validate the program, prepares students for entry level jobs and helps students to make career choices related to job placement.

It is the intent by all those involved in the development of this curriculum guide that it be used to provide relevant training or retraining for employment in the world of work.

The secondary occupational programs/courses in Michigan should meet the following minimum standards to assure soundness and quality of instruction:

1. The program of instruction must be based on a consideration of the skills and knowledge required in the occupation for which the instruction is being provided, and includes a planned logical sequence for those essentials of education or experience deemed necessary for the individual to meet an occupational objective.

2. The program of instruction must be developed and conducted in consultation with a Local Advisory Council/Committee which has an appropriate representation of both sexes and an appropriate representation of racial and ethnic minorities found in the program area, school, and community origin. The local advisory council will advise on current job needs, relevance of programs, and courses in meeting current job needs and consult with the local educational agency in developing program application.

3. The program of instruction will include the most up-to-date curriculum based on the competencies required in the occupation or occupational field in which the individual is being prepared, upgraded, or updated.

4. The program of instruction will be sufficiently extensive in duration and intensive within a schedule unit of time to enable the student to develop the necessary knowledge, attitudes, and skills necessary for employment in the occupation or occupational field.

5. The program of instruction will combine and coordinate related instruction with field, shop, laboratory, cooperative work, or other occupational experience which is appropriate to the vocational objective of the student, is of sufficient duration to develop competencies necessary for employment in the occupation or occupational field, and supervised, directed, or coordinated by a person qualified under the State Plan.

Facilities, equipment, and instructional materials:

1. Classrooms, libraries, shops, laboratories, and other facilities, including instructional equipment, supplies, teaching aids, and other materials will be adequate in supply and quality to meet the standards approved by the State Board so that such facilities are adequate to enable those who are to be trained to meet the occupational objective for which the education is intended.

2. If the State Board or local educational agency cannot provide adequate facilities and materials, and such are available in a business or industrial establishment, funds may be used to reimburse the local public educational agency for training programs conducted in private industry when it complies with the training standards and regulations established by the State Board. Such instruction shall be under the supervision and administration of a local public educational agency.

ACKNOWLEDGEMENT

The Michigan Trade and Industrial Curriculum Guide(s) were developed through a series of workshops held throughout the State and at Michigan State University during the 1983-84 school year.

Appreciation is given to all who have contributed their thoughts, time and energy to this curriculum project.

The Michigan Department of Education, Vocational-Technical Education Service, is indebted to the following individuals who were instrumental in the completion of this project and the development of the materials:

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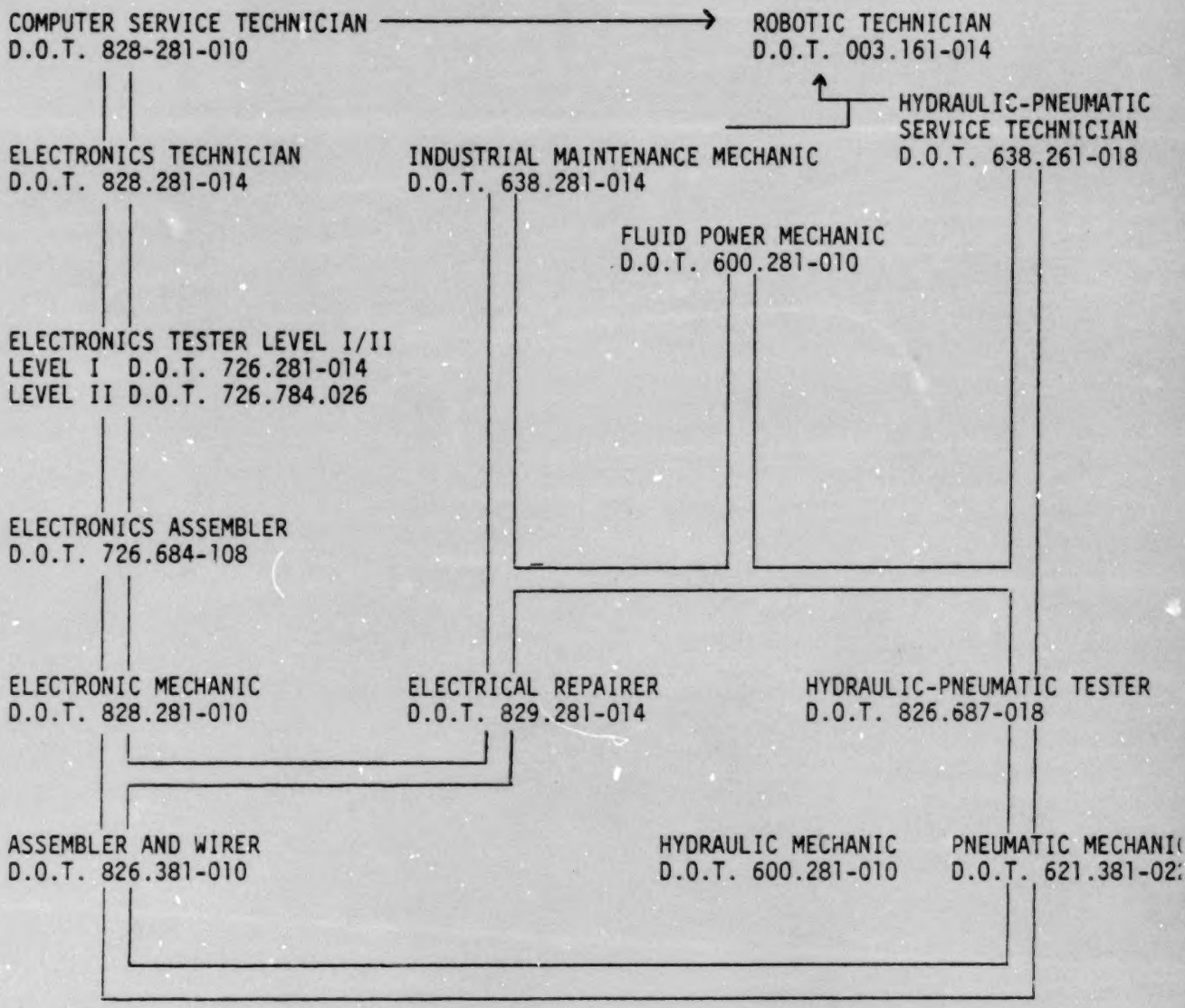
INDUSTRIAL ELECTRONICS CAREER LADDER
C.I.P. 47-0101-03



D.O.T. JOB CODE AND TITLE SHEET

INDUSTRIAL ELECTRONICS

D.O.T. NUMBER	JOB TITLE
828.281-010	Electronic Mechanic
829.281-014	Electrical Repairer
826.381-010	Assembler and Wirer
726.281-014	Electronics Tester I
726.684-018	Electronics Assembler
726.684-026	Electronics Tester II
828.281-014	Electronics Technician

(with addition of Hydraulics-Pneumatics-Robotics Program)

600.281-010	Hydraulic Mechanic
621.381-022	Pneumatic Mechanic
862.687-018	Hydraulic-Pneumatic Tester
600.281-010	Fluid Power Mechanic
638.261-018	Hydraulic-Pneumatic Service Technician
638.281-014	Industrial Maintenance Mechanic
003.161-014	Robotic Technician

RELATED CAREERS

633.281-018	Office Machine Servicer
828.281-010	Computer Service Technician (sometimes listed as Field Service Enginee
729.281-014	Electric Meter Repairer
710.281-030	Instrument Technician } (Process C
710.281-026	Instrument Maintenance Mechanic } Technicia
729.281-026	Electric Instrument Technician
829.281-014	Electrician Maintenance
019.181-010	Laser Technician
003.161-014	Robotic Technician

DUTY/TASK NUMBERS

JOB TITLES	A-1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Electronic Mechanic	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Electrical Repairer	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Assembler and Wirer	X	X	X	X	X	X	X	X	X	X	X								X
Electronics Tester I	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Electronics Assembler	X	X	X	X	X	X	X	X	X	X	X								X
Electronics Tester II	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Electronics Technician	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hydraulic Mechanic					X	X													
Pneumatic Mechanic					X	X													
Hydraulic Pneumatic Tester					X	X													
Fluid Power Mechanic					X	X													
Hydraulic Pneumatic Ser. Tech					X	X													
Indus. Main. Mechanic	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Robotic Technician	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

DUTY/TASK JOB MATRIX

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DUTY/TASK JOB MATRIX

DUTY/TASK NUMBERS	JOB TITLES	Electronic Mechanic	Electrical Repairer	Assembler and Wirer	Electronics Tester I	Electronics Assembler	Electronics Tester II	Electronics Technician	Hydraulic Mechanic	Pneumatic Mechanic	Hydraulic Pneumatic Tester	Fluid Power Mechanic	Hydraulic Pneumatic Ser. Tech	Indus. Main. Mechanic	Robotic Technician		
A - 20		X	X	X	X	X	X	X						X	X		
21		X	X	X	X	X	X	X						X	X		
22		X	X	X	X	X	X	X	X	X	X	X	X	X	X		
23					X		X	X						X	X		
B - 1		X	X	X	X	X	X	X						X	X		
2		X	X	X	X	X	X	X	X	X	X	X	X	X	X		
3		X	X	X	X	X	X	X						X	X		
4		X	X	X	X	X	X	X	X	X	X	X	X	X	X		
5		X	X	X	X	X	X	X						X	X		
6		X	X	X	X	X	X	X									
7		X	X	X	X	X	X	X									
8		X	X	X	X	X	X	X									
9		X	X	X	X	X	X	X									
10		X	X	X	X	X	X	X									
11		X	X	X	X	X	X	X									
12		X	X	X	X	X	X	X									
13		X	X	X	X	X	X	X									
14		X	X	X	X	X	X	X									

DUTY/TASK NUMBERS

JOB TITLES	A - 15	16	17	18	C - 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Electronic Mechanic											X	X	X	X	X			
Electrical Repairer											X	X	X	X	X			
Assembler and Wirer	X	X	X	X														
Electronics Tester I	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Electronics Assembler	X	X	X	X														
Electronics Tester II	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Electronics Technician	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hydraulic Mechanic																		
Pneumatic Mechanic																		
Hydraulic Pneumatic Tester																		
Fluid Power Mechanic																		
Hydraulic Pneumatic Ser. Tech																		
Indus. Main. Mechanic	X	X	X	X										X	X			
Robotic Technician	X	X	X	X									X	X	X	X	X	X

DUTY/TASK JOB MATRIX

DUTY/TASK JOB MATRIX

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DUTY/TASK NUMBERS

JOB TITLES	Electronic Mechanic	Electrical Repairer	Assembler and Wirer	Electronics Tester I	Electronics Assembler	Electronics Tester II	Electronics Technician	Hydraulic Mechanic	Pneumatic Mechanic	Hydraulic Pneumatic Tester	Fluid Power Mechanic	Hydraulic Pneumatic Ser. Tech	Indus. Main. Mechanic	Robotic Technician
C - 15				X		X	X							
16				X		X	X							X
17						X	X							X
18						X	X							X
19						X	X							X
20						X	X							X
21						X	X							X
22				X		X	X							X
23						X	X							
D - 1	X	X												
2	X	X				X	X	X	X	X	X	X	X	
3	X	X				X	X	X	X	X	X	X	X	
4	X	X	X		X	X					X	X	X	
5	X	X	X		X	X	X	X	X	X	X	X	X	
6	X	X	X		X	X	X	X	X	X	X	X	X	
7	X	X	X		X	X								
8	X	X	X		X	X					X	X	X	
9			X		X	X					X	X	X	

DUTY/TASK NUMBERS

JOB TITLES	D-10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		E-1	2	
Electronic Mechanic	X	X	X	X	X	X	X	X		X		X	X	X	X				
Electrical Repairer	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X
Assembler and Wirer	X												X						
Electronics Tester I	X		X	X				X					X	X	X				
Electronics Assembler	X												X						
Electronics Tester II	X		X	X				X					X	X	X				
Electronics Technician	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X
Hydraulic Mechanic	X													X			X	X	X
Pneumatic Mechanic	X		X	X										X			X	X	X
Hydraulic Pneumatic Tester	X		X	X					X					X			X	X	X
Fluid Power Mechanic	X		X	X										X			X	X	X
Hydraulic Pneumatic Ser. Tech	X	X	X	X		X		X		X	X	X	X	X	X		X	X	X
Indus. Main. Mechanic	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X	X
Robotic Technician	X	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X

DUTY/TASK JOB MATRIX

DUTY/TASK NUMBERS

JOB TITLES	E - 4	5	6	7	8	9	10	11	12	13	14	15	16	17		F - 1	2	3	4
Electronic Mechanic																X	X	X	X
Electrical Repairer							X			X	X	X				X	X	X	X
Assembler and Wirer																X	X	X	X
Electronics Tester I																X	X	X	X
Electronics Assembler																X	X	X	X
Electronics Tester II																X	X	X	X
Electronics Technician							X			X	X	X				X	X	X	X
Hydraulic Mechanic	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Pneumatic Mechanic	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Hydraulic Pneumatic Test	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Fluid Power Mechanic	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Hydraulic Pneumatic Ser. Tech	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Indus. Main. Mechanic	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Robotic Technician							X			X	X	X				X	X	X	X

DUTY/TASK [illegible] MATRIX

DUTY/TASK JOB MATRIX

DUTY/TASK NUMBERS 21

JOB TITLES	Electronic Mechanic	Electrical Repairer	Assembler and Wirer	Electronics Tester I	Electronics Assembler	Electronics Tester II	Electronics Technician	Hydraulic Mechanic	Pneumatic Mechanic	Hydraulic Pneumatic Tester	Fluid Power Mechanic	Hydraulic Pneumatic Ser. Tech	Indus. Main. Mechanic	Robotic Technician		
F - 5	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
6	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
7	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
8	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
9	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
10	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
11	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
12	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
13	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
14	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
15	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
16	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
17	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
18	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
19	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
20	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
21	X	X	X	X	X	X	X	X	X	X	X	X	X	X		

TASK LIST
FOR
INDUSTRIAL ELECTRONICS

A. PERFORMING RELATED ELECTRONICS ACTIVITIES

1. Identify a resistor's value, using appropriate color code and manufacturer's specification, to verify component.
2. Identify an inductor, using proper assembly data sheet, to verify component.
3. Identify a transformer, using proper assembly data sheet, to verify component.
4. Identify a capacitor, using proper assembly data sheet, to verify component.
5. Identify a fuse, using power assembly data sheet, to verify component.
6. Identify a potentiometer, using proper assembly data sheet, to verify component.
7. Identify a diode, using proper assembly data sheet, to verify component.
8. Identify a transistor, using proper assembly data sheet, to verify component.
9. Identify an integrated circuit, using proper assembly data sheet, to verify component.
10. Draw a schematic diagram, using electrical/electronic symbols, to implement basic circuits.
11. Identify component and electrical terms, using schematic and process sheets, to locate components in circuitry.
12. Demonstrate proper techniques, using basic test equipment, to verify equipment operation.
13. Analyze and measure basic D.C. circuits, using OHM's, Kirchhoff's Thevenin's, Norton's theorms and laws, test equipment, to verify findings.
14. Perform measurement of A.C., using test equipment and knowledge, to analyze signals.
15. Analyze and measure RC and RL time constants, using knowledge and test equipment, to verify findings.
16. Analyze digital logic gates, using knowledge and truth tables, to show inputs and outputs.
17. Analyze flip-flops, using knowledge and truth tables, to show inputs and outputs.
18. Analyze a digital microprocessor's central processing units (CPU) circuitry, using knowledge, data sheets, schematics and block diagrams, to gain experience with CPU's operation.

A. PERFORMING RELATED ELECTRONICS ACTIVITIES (continued)

19. Perform soldering of components on a printed circuit board, using hand tools, schematic and process sheet to assemble/repair circuitry.

20. Perform soldering/repair of wires, ribbon cables, wire harnesses, using hand tools, schematic and process sheet to assemble/repair circuitry.

21. Performing repair of wires, ribbon cables, edge-on connectors using hand tools, schematics and process sheet to assemble/repair circuitry.

22. Prepare a parts list for prototype/production equipment, using production schedules and process sheet, to insure parts availability.

23. Write a summary report, using data sheets and test data, to complete quality-assessment checks.

B. ASSEMBLING SUB-ASSEMBLIES AND COMPLETE UNITS

1. Remove/install components on a circuit board, using hand tools, holding fixtures, and assembly process sheet, to complete an assembly.

2. Install component parts on a chassis/panel, using hand tools, process sheet, and blueprint, to complete an assembly.

3. Construct wireharness, using hand tools, soldering iron, wire, tabs, terminals and assembly drawings, to complete an operational assembly.

4. Connect assembly with power sources, using hand tools, switch panels, junction boxes, test meters, wiring diagrams, and blueprints, to obtain an operational condition.

5. Connect motor and control devices, using hand tools, blueprints, process sheets, and wiring diagrams, to obtain an operational condition.

6. Assemble a power supply, using proper tools, fixtures, process sheet, and components, to produce an operational assembly.

7. Assemble an amplifier, using proper tools, fixtures, process sheet, and components, to produce an operational assembly.

8. Assemble a digital display unit, using proper tools, fixtures, and components, to complete an assembly sheet.

9. Construct a clock and timing circuit, using knowledge, hand tools, components, process sheet and schematic, to produce an operational assembly.

10. Construct a digital counter circuit, using knowledge, hand tools, schematic, process sheet and components, to produce an operational assembly.

B. ASSEMBLING SUB-ASSEMBLIES AND COMPLETE UNITS (continued)

11. Construct a digital register, using knowledge, hand tools, components, schematic and process sheet, to produce an operational assembly.

12. Construct encoder and decoder circuits, using knowledge, hand tools, materials, process sheet and schematic, to produce an operational assembly.

13. Construct multiplexer and demultiplexer circuits, using knowledge, hand tools, materials, process sheet and schematic, to produce an operational assembly.

14. Construct a digital central processing unit, using knowledge, process sheets, data sheets, schematics and hand tools, to produce an operational unit.

15. Interface an external timing signal, using hand tools and schematic, to synchronize the microprocessor.

16. Interface memory circuit to a microprocessor, using hand tools and schematics, to insure reliable operation.

17. Interface an anolog-to-digital converter, using hand tools and schematic, to operate an input sensor with a microprocessor system.

18. Interface an external data display, using hand tools and schematic, to operate a microprocessor.

C. TESTING COMPONENTS, ASSEMBLIES, AND SYSTEMS

1. Perform test/measurement of a resistor, using test equipment and appropriate measuring device and data sheets, to verify that the component meets the specifications.

2. Perform test/measurement of a resistor network, using proper measuring devices, data sheet and blueprint test equipment, to verify that the component meets the specifications.

3. Perform test/measurement of an inductor, using proper tools, test equipment, and specification data, to verify that the component meets the specifications.

4. Perform test/measurement of a capacitor, using proper tools, test equipment, and specification data, to verify that the component meets the specifications.

5. Perform test/measurement of a transformer, using proper tools, equipment, and specification data, to verify that the device meets the specifications.

6. Perform test/measurement of a diode, using test equipment, appropriate measuring device and data sheet, to verify that the component meets the specifications.

C. TESTING COMPONENTS, ASSEMBLIES, AND SYSTEMS (continued)

7. Test electronic function of assemblies, using test equipment, hand tools, and performance data sheets, to verify that the unit meets the specifications.

8. Perform test of a power supply, using proper tools, fixtures, test equipment, and data sheet, to verify that the device meets the electrical specifications.

9. Perform test/measurement of an amplifier, using proper hand tools, test equipment, and data sheet, to verify operational condition.

10. Perform functional test of a D.C. motor, using hand tools, test equipment, and data sheet, to verify operation.

11. Perform functional test of an A.C. motor, using hand tools, test equipment, and data sheet, to verify operation.

12. Perform test/measurement of a clock and timing circuit, using knowledge, test equipment, data sheet and schematic, to verify that the circuit meets specifications.

13. Perform test/measurement of a digital counter circuit, using knowledge, test equipment, schematic and data sheet, to verify that the circuit meets the specifications.

14. Perform test/measurement of a digital register circuit, using knowledge, test equipment, data sheet and schematic, to verify that the circuit meets the specifications.

15. Perform test/measurement of encoder and decoder circuits, using knowledge, test equipment, data sheet and schematic, to verify that the circuit meets the specifications.

16. Perform test/measurement of multiplexer and demultiplexer circuits, using knowledge, test equipment, data sheet and schematic, to verify that the circuit meets the specifications.

17. Develop a straight line program, using program instructions and microprocessor, to demonstrate program operation.

18. Develop a microprocessor program, using program instructions and microprocessor, to demonstrate the use of subroutines and gain experience writing programs.

19. Develop a microprocessor program, using program instructions, stack operations, and microprocessor, to demonstrate automatic functions.

20. Develop a microprocessor program, using software instructions and microprocessor, to verify program operation and debugging procedures.

21. Develop a microprocessor program, using program instructions and microprocessor, to gain experience writing programs.

C. TESTING COMPONENTS, ASSEMBLIES, AND SYSTEMS (continued)

22. Perform operational test of a digital display unit, using proper tools, fixtures, test equipment, assembly sheet, and schematics, to verify that the unit meets the specifications.

23. Perform test/measurement of a digital microprocessor central processing unit, using knowledge, data sheets, schematics, process sheets, and test equipment, to verify that the CPU meets the specifications.

D. SERVICING COMPONENTS, ASSEMBLIES, AND SYSTEMS

1. Clean equipment, using proper material, to remove contaminants that affect operation.

2. Clean/lubricate mechanical drive components, using accepted procedures and chemicals, to obtain normal operation.

3. Clean/lubricate a motor, using accepted procedures and chemicals, to obtain normal operation.

4. Replace a light bulb, using appropriate equipment, to restore light bulbs.

5. Replace a bulb socket, using appropriate equipment, to restore the bulb socket to operation.

6. Test switches, using appropriate equipment, to detect resistance outside manufacturer's specifications.

7. Bypass a switch, using appropriate materials, to determine possible switch failure.

8. Replace switches, using appropriate equipment, to restore the switch to operation.

9. Calibrate unit, using hand tools, test equipment, and data sheet, to insure unit meets operational specifications.

10. Adjust mechanical part(s), using hand tools, standard gauges, test fixtures, process sheets and blueprints, to insure that the part meets the operational specifications.

11. Diagnose cause of malfunction of motor control panel, using hand tools, multimeter and schematics, to obtain normal operation.

12. Diagnose cause of malfunction, using test equipment, hand tools, and schematics, to replace defective component.

13. Diagnose cause of malfunction, using test equipment, hand tools, service manuals, schematics, wiring diagrams, and blueprints, to replace defective module/printed circuit board.

14. Service faulty equipment, using hand tools, test equipment, schematics, and service manual, to assure proper operation.

D. SERVICING COMPONENTS, ASSEMBLIES, AND SYSTEMS (continued)

15. Diagnose cause of malfunction, using test equipment, hand tools, service manuals, and schematics, to repair defective motor.

16. Service transformer(s), using voltmeter and all necessary tools, to determine voltage output.

17. Demonstrate the use of test meters, using selected test instruments, to determine values of electricity.

18. Service capacitor(s), using appropriate test meters, to determine the condition of the capacitors.

19. Service relays/contactors, using necessary test instruments, to insure proper operation.

20. Service motor(s), using knowledge and all necessary tools, to determine condition of motor windings.

21. Service controls, using knowledge and necessary tools, to determine operating conditions.

22. Locate electrical symbols, using appropriate materials, to identify electrical parts on a schematic.

23. Replace instrument gauges, using appropriate equipment, to restore the instrument gauge to operation.

24. Measure resistance of a circuit, using appropriate equipment, to compare to manufacturer's specifications.

E. MAINTAINING HYDRAULIC AND PNEUMATIC SYSTEMS

1. Install pipes/tubes/hoses, using knowledge and hand tools, to complete a system hook up.

2. Check pressure relief valve, using knowledge and necessary tools, to insure proper operation.

3. Install flexible coupling between electric motor and hydraulic pump, using knowledge, hand tools and manufacturer's specifications, to obtain maximum efficiency.

4. Adjust the pressure on a hydraulic system, using knowledge, test instruments and necessary tools, to insure proper operation.

5. Inspect/test a hydraulic in-line check valve, using knowledge, hand tools and manufacturer's manual, to confirm proper operation.

6. Inspect/test a hydraulic relief valve, using knowledge, hand tools and manufacturer's manual, to confirm proper operation.

E. MAINTAINING HYDRAULIC AND PNEUMATIC SYSTEMS (continued)

7. Inspect/test a hydraulic flow control valve, using knowledge, hand tools and manufacturer's manual, to confirm proper operation.

8. Inspect/test rotating group of hydraulic vane pump, using knowledge, hand tools, and manufacturer's manual, to confirm operation specifications.

9. Inspect/test a hydraulic pressure reducing valve, using knowledge, hand tools and manufacturer's manual, to confirm proper operation.

10. Inspect/test a hydraulic four-way directional valve, using knowledge, hand tools, and manufacturer's manual, to insure proper operation.

11. Install a flow control and/or speed control valve(s), using knowledge and necessary tools, to insure proper operation.

12. Replace a pneumatic pressure regulator, using knowledge, test instruments and necessary tools, to insure proper operation.

13. Replace a two-way valve (solenoid operated), using knowledge and necessary tools, to insure proper operation.

14. Replace a three-way valve (solenoid operated), using knowledge, test instruments and necessary tools, to insure proper operation.

15. Replace a four-way valve (solenoid operated), using knowledge, test instruments and necessary tools, to maintain proper operation.

16. Replace a hydraulic pump, using knowledge and necessary tools, to insure proper operation.

17. Check a hydraulic pressure regulator, using knowledge, test instruments and necessary tools, to insure proper operation.

F. USING EMPLOYABILITY SKILLS

1. Perform a self-assessment, using knowledge and information, to compile a list of personal attributes.

2. Perform a self-assessment, using knowledge and information, to identify areas of work that will provide personal job satisfaction.

3. Perform a self-assessment, using knowledge and information, to determine methods to reduce levels of stress.

4. Compile an occupational profile, using reference materials, to determine the characteristics, requirements, and employment outlook of an occupation.

5. Investigate non-wage job characteristics, using available resources, to identify significant job factors.

F. USING EMPLOYABILITY SKILLS (continued)

6. Develop goals, using knowledge, to determine career objective(s).

7. Perform a job search, using information, to identify employment opportunities.

8. Participate in an information interview, using knowledge and resources, to obtain information about a job from an employer.

9. Complete a social security form, using information, to apply for a social security number.

10. Contact an employer, using a telephone, to pursue potential employment opportunities.

11. Complete a job application, using personal notes, to apply for employment.

12. Prepare a resume, using personal information, to apply for a job.

13. Write a letter, using personal notes, to apply for a position.

14. Demonstrate appropriate dress, using a knowledge of job requirements, to comply with standards of on-the-job attire and grooming.

15. Interview for a job, using communication skills, to secure employment.

16. Contact a job interviewer, using a telephone, to accept/reject a job.

17. Complete forms, using information, to withhold city, state, and federal taxes.

18. Describe performance evaluation measurements, using knowledge, to identify behavior/attitudes that employers expect employees to exhibit on-the-job.

19. Perform a continuing education program search, using available resources, to identify opportunities for retraining, skills upgrading, and career advancement.

20. Analyze career information, using available resources, to identify the opportunities for advancement that exist within an occupation.

21. Describe job resignation/dismissal practice, using knowledge, to identify positive methods for terminating an employment situation.

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 1

Task: Identify a resistor's value, using appropriate color code and manufacturer's specification, to verify component.

Achievement Indicators: The learner:	Yes	No
1. Obtained specifications -	____	____
2. Determined resistive value -	____	____
3. Determined tolerance -	____	____
4. Determined wattage -	____	____
5. Determined type -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:**
	Standard Color Code Manufacturer's Specification Sheet Assembly Data Sheet

Teacher Activities	Student Learning Activities
Review One of the most commonly used components in electronics is the resistor. 1. How many of you can determine the resistance of a resistor by its color code? 2. Can you determine its wattage and type? Overview 1. Present a lecture discussion on the importance of selecting the correct component in the design, assembly and servicing of electronic equipment. Presentation 1. Demonstrate how to read a resistors OHMIC valve (RESISTANCE) using the standard color code. 2. Demonstrate how to determine a resistor's tolerance using the standard color code. 3. Demonstrate how to determine a resistor's wattage using the manufacturer's data sheet to verify dimensions. 4. Demonstrate how to determine resistor type using the manufacturer's data sheet. Exercise Assemble different types and valves of resistors. Have the students calculate the resistive valves and tolerance using the color code. Ask the students to make dimensional measurements to verify wattage and type. Summary Evaluate the students' demonstration of the task using the achievement indicators as a guide. Administer a quiz related to this task and evaluate the results.	Exercise 1. Read the assigned resoures and references for this task. 2. Attend a lecture/discussion on manufacturer's specifications for resistors. 3. Observe the demonstration of the task. 4. Calculate the resistance of a given number of resistors using the color code. 5. Calculate the tolerance of a given number of resistors using the color code. 6. Calculate the wattage of a given number of resistors by measuring the dimensions and using the manufacturer's data sheet. 7. Identify the type of resistor using the data sheet. 8. Demonstrate the task satisfactorily to an evaluator. 9. Demonstrate proficiency on a quiz related to this task.

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 2

Task: Identify an inductor, using proper assembly data sheet, to verify component.

Achievement Indicators: The learner:

	Yes	No
1. Obtained data sheet -	____	____
2. Determined type -	____	____
3. Determined coil/inductor value -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Resources:

Assembly Data Sheet
Manufacturer's Specification Sheet

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 3

Task: Identify a transformer, using proper assembly data sheet, to verify component.

Achievement Indicators: The learner:	Yes	No
1. Obtained data sheet	____	____
2. Determined type -	____	____
3. Determined device had correct number of input-output leads or connections -	____	____
4. Determined input/output voltage value -	____	____
5. Determined current rating -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:**
	Assembly Data Sheet Manufacturer's Specification Sheet

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 4

Task: Identify a capacitor, using proper assembly data sheet, to verify component.

Achievement Indicators: The learner:

	Yes	No
1. Obtained data sheet -	____	____
2. Determined type -	____	____
3. Determined capacitor's value -	____	____
4. Determined capacitor's working voltage -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Resources:

Assembly Data Sheet
Manufacturer's Specification Sheet

Duty: Performing Related Electronics Activities

Duty No. A

Task No. 5

Task: Identify a fuse, using proper assembly data sheet, to verify component.

Achievement Indicators: The learner:

	Yes	No
1. Obtained data sheet -	____	____
2. Determined type -	____	____
3. Determined voltage value -	____	____
4. Determined current value -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Resources:

Assembly Data Sheet
Manufacturer's Specification Sheet

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 6

Task: Identify a potentiometer, using proper assembly data sheet, to verify component.

Achievement Indicators: The learner:

	Yes	No
1. Obtained specifications -	____	____
2. Determined type -	____	____
3. Determined resistive value -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Resources:

Assembly Data Sheet
Manufacturer's Specification Sheet

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 7

Task: Identify a diode, using proper assembly data sheet, to verify component.

Achievement Indicators: The learner:	Yes	No
1. Obtained data sheet -	____	____
2. Determined type -	____	____
3. Determined voltage rating -	____	____
4. Determined current rating -	____	____
5. Identified the Anode lead and Cathode lead -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:** Manufacturer's Data Sheet

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 8

Task: Identify a transistor, using proper assembly data sheet, to verify component.

Achievement Indicators: The learner:

	Yes	No
1. Obtained data sheet -	_____	_____
2. Determined type -	_____	_____
3. Identified transistor leads -	_____	_____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Resources:

Assembly Data Sheet
Manufacturer's Specification Sheet

Duty: Performing Related Electronics Activities

Duty No. A

Task No. 9

Task: Identify an integrated circuit, using proper assembly data sheet, to verify component.

Achievement Indicators: The learner:

	Yes	No
1. Obtained data sheet -	____	____
2. Determined I.C. type -	____	____
3. Identified I.C. leads/pins -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Resources:

Assembly Data Sheet
Manufacturer's Specification Sheet

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 10

Task: Draw a schematic diagram, using electrical/electronic symbols, to implement basic circuits.

Achievement Indicators: The learner:

	Yes	No
1. Identified common features of schematics -	____	____
2. Identified differences in schematics -	____	____
3. Used correct symbols identifying component's wires and connections -	____	____
4. Identified series, parallel and series, parallel circuits -	____	____
5. Identified symbols and circuits used in industrial schematics -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the industrial standards.

Tools and Equipment:

Resources:

Electrical and Electronics Graphics Sysmbols and Reference Designations. ANSI/IEEE Y 32 E

Electrical Standards for Mass Production Equipment and General Purpose Machine Tools. (JIC) No. EMP-1-67, EPG-1-67

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 11

Task: Identify component and electrical terms, using schematic and process sheets, to locate components in circuitry.

Achievement Indicators: The learner:	Yes	No
1. Located physical placement of components -	____	____
2. Identified components on the schematic -	____	____
3. Identified component reference designation -	____	____
4. Identified component by part number and item number -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturing specifications.

Tools and Equipment:	**Resources:**
	Manufacturer's Schematic, Process Sheet and Pictorial

Duty: Performing Related Electronics Activities

Duty No. A

Task No. 12

Task: Demonstrate proper techniques, using basic test equipment, to verify equipment operation.

Achievement Indicators: The learner:

	Yes	No
1. Completed test equipment set-up and wiring to conduct performance tests -	____	____
2. Read instrument dial or scope that indicated resistance, voltage, current or wave pattern, frequency/period -	____	____
3. Compared instrument readings with standard -	____	____
4. Calibrated test equipment as required -	____	____
5. Observed safety rules and procedures during all phases of operation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's manuals.

Tools and Equipment:
Multimeter
Voltmeter
Ammeter
Scope
Frequency Counter
Hook-up Leads

Resources:
Manufacturer's Specifications

Duty: Performing Related Electronic Activities	**Duty No.** A
	Task No. 13

Task: Analyze and measure basic D.C. circuits, using OHM's, Kirchhoff's Thevenin's, Norton's theorms and laws, test equipment, to verify findings.

Achievement Indicators: The learner:	Yes	No
1. Calculated resistance, voltage drops, current wattage of a given series circuit -	____	____
2. Performed measurements of a given series circuit and components to verify calculations -	____	____
3. Calculated resistance, voltage drops, current, wattage of a given parallel circuit -	____	____
4. Performed measurements of a given parallel circuit -	____	____
5. Calculated resistance, voltage drops, current, wattage of a given series - parallel circuit -	____	____
6. Performed measurements of a given series - parallel circuit and components to verify calculations -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the circuit specifications.

Tools and Equipment:	**Resources:**
Voltmeter Ohmmeter Current Meter Wattmeter Multimeter	

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 14

Task: Perform measurement of A.C., using test equipment and knowledge, to analyze signals.

Achievement Indicators: The learner:	Yes	No
1. Set up test equipment to perform measurement of signals -	____	____
2. Completed frequency measurement using a oscilloscope -	____	____
3. Completed frequency measurement using a frequency counter -	____	____
4. Completed amplitude measurement using a oscilloscope (peak and peak to peak voltage) -	____	____
5. Completed voltage measurement using a voltmeter (RMS voltage) -	____	____
6. Completed period measurement using a oscilloscope -	____	____
7. Completed period measurement using the period function of a frequency counter -	____	____
8. Analyzed signals by comparing signal amplitude - peak, peak to peak, RMS, AVE -	____	____
9. Analyzed signals by comparing frequency and period -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Voltmeter
Oscilloscope
Frequency/Period Counter
Signal Generator
Hook-up Leads

Resources:

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 15

Task: Analyze and measure RC and RL time constants, using knowledge and test equipment, to verify findings.

Achievement Indicators: The learner:	Yes	No
1. Calculated the time constant of a given RC circuit -	____	____
2. Measured signal generated by circuit using:		
a. voltmeter -	____	____
b. frequency counter -	____	____
c. oscilloscope -	____	____
3. Calculated the time constant of a given RL circuit -	____	____
4. Measured signal generated by circuit using:		
a. voltmeter -	____	____
b. frequency counter -	____	____
c. oscilloscope -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the circuit specifications.

Tools and Equipment:	**Resources:**
Voltmeter Frequency Counter Oscilloscope Test Leads	

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 16

Task: Analyze digital logic gates, using knowledge and truth tables, to show inputs and outputs.

Achievement Indicators: The learner:	Yes	No
1. Developed a truth table to show all inputs and outputs for a NOT gate -	____	____
2. Developed a truth table to show all inputs and outputs for a AND gate -	____	____
3. Developed a truth table to show all inputs and outputs for a OR gate -	____	____
4. Developed a truth table to show all inputs and outputs for a NAND gate -	____	____
5. Developed a truth table to show all inputs and outputs for a NOR gate -	____	____
6. Developed a truth table to show all inputs and outputs for a XOR gate -	____	____
7. Developed a truth table to show all inputs and outputs for a XNOR gate -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:**

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 17

Task: Analyze flip-flops, using knowledge and truth tables, to show inputs and outputs.

Achievement Indicators: The learner:

	Yes	No
1. Developed a truth table to show all inputs and outputs of a R-S latch -	____	____
2. Developed a truth table to show all inputs and outputs of a D-type flip-flop -	____	____
3. Developed a truth table to show all inputs and outputs of a J-K flip-flop -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:**

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 18

Task: Analyze a digital microprocessor's central processing units (CPU) circuitry, using knowledge, data sheets, schematics and block diagrams, to gain experience with CPU's operation.

Achievement Indicators: The learner:	Yes	No
1. Obtained all material to properly analyze circuits and systems -	____	____
2. Identified and analyzed the control circuits -	____	____
3. Identified and analyzed the arithmetic - logic unit (ALU) -	____	____
4. Identified and analyzed the address bus -	____	____
5. Identified and analyzed the data bus -	____	____
6. Identified and analyzed the input/output ports (I/O) -	____	____
7. Identified and analyzed the memory unit -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
	Data Sheets, Schematics, Block Diagrams

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 19

Task: Perform soldering of components on a printed circuit board, using hand tools, schematic and process sheet to assemble/repair circuitry.

Achievement Indicators: The learner:	Yes	No
1. Selected the proper soldering equipment -	____	____
2. Obtained schematic and/or process sheet -	____	____
3. Removed defective component(s) as required -	____	____
4. Performed visual inspection of circuitry after component removal/desoldering for lifted foil -	____	____
5. Installed components as required, insuring a good mechanical connection was made before soldering -	____	____
6. Soldered component(s) attaching a heat sink, if required -	____	____
7. Observed polarity on components such as electrolytic capacitors, diodes -	____	____
8. Inspected completed work for solder bridges, cold solder joints -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

Tools and Equipment:	**Resources:**
Slip-Joint Pliers; Long-Nose Pliers; Diagonal Cutters; Wire-Strippers, Screwdrivers, Nutdrivers, Soldering Irons, 100-200 Watts, 25 Watts Soldering Iron Holder; Solder Extractor/Solder Sucker, Solder	Schematics, Process Sheet

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 20

Task: Perform soldering/repair of wires, ribbon cables, wire harnesses, using hand tools, schematic and process sheet to assemble/repair circuitry.

Achievement Indicators: The learner:	Yes	No
1. Obtained schematic and process sheet -	____	____
2. Selected proper soldering equipment -	____	____
3. Performed wire preparation - stripped insulation, tinned the wire -	____	____
4. Insured that the insulation approached the terminal -	____	____
5. Soldered wires provided a service loop as required -	____	____
6. Inspected the connection for cold solder joints, solder bridges -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

Tools and Equipment:	**Resources:**
Slip-Joint Pliers; Long-Nose Pliers; Diagonal Cutters; Wire-Strippers, Screwdrivers, Nutdrivers, Soldering Irons, 100-200 Watts, 25 Watts Soldering Iron Holder; Solder Extractor/Solder Sucker, Solder	Schematics, Process Sheet

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 21

Task: Performing repair of wires, ribbon cables, edge-on connectors using hand tools, schematics and process sheet to assemble/repair circuitry.

Achievement Indicators: The learner:	Yes	No
1. Obtained schematic and process sheet -	____	____
2. Selected proper hardware and crimping tool -	____	____
3. Performed wire preparation - stripped insulation -	____	____
4. Insured that the insulation approached the terminal -	____	____
5. Insured that a good mechanical connection was made during crimping operation -	____	____
6. Installed wire tab to connector block securely, but not straining the wires -	____	____
7. Performed ring-out test -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

Tools and Equipment:	**Resources:**
Multimeter, Slip-Joint Pliers, Long-Nose Pliers, Diagonal Cutters, Wire-Stripper, Crimping Tool, Hardware	Schematics, Process Sheet

Duty: Performing Related Electrcnics Activities	**Duty No.** A
	Task No. 22

Task: Prepare a parts list for prototype/production equipment, using production schedules and process sheet, to insure parts availability.

Achievement Indicators: The learner:

	Yes	No
1. Obtained production schedules, process sheet -	____	____
2. Completed list of components and parts required per unit -	____	____
3. Identified parts by nomenclature or description -	____	____
4. Identified parts by code number, item/find number -	____	____
5. Checked process sheet for stock correction, revisions -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:**

Duty: Performing Related Electronics Activities	**Duty No.** A
	Task No. 23

Task: Write a summary report, using data sheets and test data, to complete quality-assessment checks.

Achievement Indicators: The learner:	Yes	No
1. Stated objective clearly -	____	____
2. Identified equipment and materials used -	____	____
3. Described procedures using schematics, block diagrams tables, graphs and sample calculations which illustrated important results -	____	____
4. Completed test results related to the objective of the experiment -	____	____
5. Summarized the significance of the results. The report should explain why, how and what happened. (Checked for spelling) -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:**

Duty: Assembling Sub-Assemblies and Complete Units	**Duty No.** B
	Task No. 1

Task: Remove/install components on a circuit board, using hand tools, holding fixtures, and assembly process sheet, to complete an assembly.

Achievement Indicators: The learner:	Yes	No
1. Obtained process sheet -	____	____
2. Obtained components -	____	____
3. Performed visual inspection of circuitry after component removal/desoldering -	____	____
4. Installed/soldered components as required -	____	____
5. Observed polarity on sensitive components such as diodes or electrolytic capacitors -	____	____
6. Performed visual inspection for cold solder joints - solder bridges -	____	____
7. Completed documentation of component installation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:**
Soldering Iron Diagonal Cutters Long-Nose Pliers Holding Fixture	Process Sheet Blueprint

Teacher Activities	Student Learning Activities
Review 1. How many of you have used a soldering iron and hand tools to assemble an electronics kit or project? 2. Did you complete the kit or project? 3. What was the hardest part in assembling the kit or project? Overview Discuss how the assembly of circuit boards are performed in an industrial setting. Show film strip of soldering techniques. Presentation 1. Demonstrate how a process sheet is used to show how and where the components are to be installed. 2. Demonstrate how the parts list is used to insure the correct components are installed. 3. Demonstrate assembly and soldering techniques used to install components on printed circuit boards. 4. Discuss the importance performing a visual inspection of completed work. 5. Discuss the need to document completed work. Exercise Have students practice these skills by installing components on circuit boards. Summary What is required to install components on a circuit board in an industrial setting? Evaluate the students' demonstration of the task using the achievement indicators as a guide.	Exercise 1. Attend discussion on component assembly on circuit boards. 2. Attend film strip on soldering techniques. 3. Read assigned resources and references for this task. 4. Observe the demonstration of the task. 5. Perform the task using a process sheet, parts list, and hand tools. 6. Demonstrate the task satisfactorily in an evaluation.

Duty: Assembling Sub-Assemblies and Complete Units	**Duty No.** B
	Task No. 2

Task: Install component parts on a chassis/panel, using hand tools, process sheet, and blueprint, to complete an assembly.

Achievement Indicators: The learner:	Yes	No
1. Obtained process sheet and blueprint -	____	____
2. Obtained specified components and hardware -	____	____
3. Examined components to insure they were free from defects -	____	____
4. Installed components to specification -	____	____
5. Attached hardware and seals -	____	____
6. Entered required information to complete records -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Screwdrivers
Diagonal Cutters
Long Nose Pliers
Nutdrivers
Wrenches
Soldering Iron

Resources:

Process Sheet
Blueprint

Duty: Assembling Sub-Assemblies and Complete Units

Duty No. B

Task No. 3

Task: Construct wireharness, using hand tools, soldering iron, wire, tabs, terminals and assembly drawings, to complete an operational assembly.

Achievement Indicators: The learner:	Yes	No
1. Obtained assembly drawing -	____	____
2. Obtained specified wire and hardware -	____	____
3. Aligned and joined wire to tabs, terminals, and connectors -	____	____
4. Routed and laced harness to form specification -	____	____
5. Performed visual inspection of wireharness -	____	____
6. Performed continuity test -	____	____
7. Determined procedures to improve assembly methods -	____	____
8. Entered required information to complete records -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Screwdrivers
Diagonal Cutters
Crimping Tools
Insertion Tools
Extraction Tools
Soldering Iron

Resources:

Assembly Drawing
Blueprint

Duty: Assembling Sub-Assemblies and Complete Units | **Duty No.** B | **Task No.** 4

Task: Connect assembly with power sources, using hand tools, switch panels, junction boxes, test meters, wiring diagrams, and blueprints, to obtain an operational condition.

Achievement Indicators: The learner:

	Yes	No
1. Obtained wiring diagram and blueprint -	____	____
2. Obtained wiring and hardware -	____	____
3. Connected assembly to power source as specified* -	____	____
4. Performed visual inspection* -	____	____
5. Performed operational test using voltmeter* -	____	____
6. Completed documentation -	____	____
7. Observed safety practices during hook-up and test -	____	____

*Potential shock hazard, high voltage

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Screwdrivers
Nutdrivers
Wire Stripper
Pliers
Diagonal Cutters
Voltmeter

Resources:

Wiring Diagram
Blueprint

Duty: Assembling Sub-Assemblies and Complete Units	**Duty No.** B
	Task No. 5

Task: Connect motor and control devices, using hand tools, blueprints, process sheets, and wiring diagrams, to obtain an operational condition.

Achievement Indicators: The learner:	Yes	No
1. Obtained required data -	____	____
2. Obtained required devices and components -	____	____
3. Performed visual inspection of completed work -	____	____
4. Completed hook-up to specifications -	____	____
5. Performed operational check -	____	____
6. Entered information to complete records -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:**
Assorted Screwdrivers Wrenches Wire Cutters/Crimper Voltmeter	Blue Print Wiring Diagram Process Sheet

Duty: Assembling Sub-Assemblies and Complete Units	**Duty No.** B
	Task No. 6

Task: Assemble a power supply, using proper tools, fixtures, process sheet, and components, to produce an operational assembly.

Achievement Indicators: The learner:

	Yes	No
1. Obtained components specified in assembly sheet -	____	____
2. Constructed assembly in accordance with data sheet -	____	____
3. Performed visual check of assembly -	____	____
4. Completed appropriate documentation of assembly form -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Screwdrivers, Assorted
Nutdrivers
Solder
Soldering Iron
Holding Fixture

Resources:

Assembly Data Sheet

Duty: Assembling Sub-Assemblies and Complete Units

Duty No. B

Task No. 7

Task: Assemble an amplifier, using proper tools, fixtures, process sheets, and components, to produce an operational assembly.

Achievement Indicators: The learner:

	Yes	No
1. Obtained assembly data sheet -	____	____
2. Obtained components specified in assembly sheet -	____	____
3. Constructed amplifier in accordance with data sheet -	____	____
4. Performed visual inspection -	____	____
5. Completed appropriate documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Nutdrivers
Screwdrivers
Soldering Iron
Solder Holding Fixture

Resources:

Assembly Data Sheet

Duty: Assembling Sub-Assemblies and Complete Units	**Duty No.** B
	Task No. 8

Task: Assemble a digital display unit, using proper tools, fixtures, and components, to complete an assembly sheet.

Achievement Indicators: The learner:

	Yes	No
1. Obtained assembly sheet -	____	____
2. Obtained required components -	____	____
3. Constructed unit in accordance with assembly sheet -	____	____
4. Performed visual inspection -	____	____
5. Completed assembly documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:
Screwdrivers
Nutdrivers
Wire-wrapping Tools
Diagonal Cutters
Long Nose Pliers
Soldering Iron
Holding Fixture

Resources:
Assembly Data Sheet
Blueprint

Duty: Assembling Sub-Assemblies and Complete Units	**Duty No.** B
	Task No. 9

Task: Construct a clock and timing circuit, using knowledge, hand tools, components, process sheet and schematic, to produce an operational assembly.

Achievement Indicators: The learner:	Yes	No
1. Obtained all materials necessary to complete assembly -	____	____
2. Constructed clock and timing circuit as per process sheet, schematic -	____	____
3. Performed visual inspection of completed work -	____	____
4. Completed assembly documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Tool Kit	Process Sheet, Schematic

Duty: Assembling Sub-Assemblies and Complete Units	**Duty No.** B
	Task No. 10

Task: Construct a digital counter circuit, using knowledge, hand tools, schematic, process sheet and components, to produce an operational assembly.

Achievement Indicators: The learner:	Yes	No
1. Obtained all materials required to complete assembly -	____	____
2. Constructed circuit per process sheet, schematic -	____	____
3. Performed visual inspection of completed assembly -	____	____
4. Completed appropriate documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Tool Kit	ess Sheet, Schematic

Duty: Assembling Sub-Assemblies and Complete Units	**Duty No.** 8
	Task No. 11

Task: Construct a digital register, using knowledge, hand tools, components, schematic and process sheet, to produce an operational assembly.

Achievement Indicators: The learner:	Yes	No
1. Obtained all materials required to complete assembly -	____	____
2. Constructed register circuit per process sheet, schematic -	____	____
3. Performed visual inspection of completed work -	____	____
4. Completed appropriate documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Tool Kit	Process Sheet, Schematic

Duty: Assembling Sub-Assemblies and Complete Units	**Duty No.** B
	Task No. 12

Task: Construct encoder and decoder circuits, using knowledge, hand tools, materials, process sheet and schematic, to produce an operational assembly.

Achievement Indicators: The learner:	Yes	No
1. Obtained all materials required to complete the assembly -	____	____
2. Assembled the encoder - decoder circuit as per process sheet instructions -	____	____
3. Performed visual inspection of completed work -	____	____
4. Recorded assembly documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Tool Kit	Process Sheet, Schematic

Duty: Assembling Sub-Assemblies and Complete Units	**Duty No.** B
	Task No. 13

Task: Construct multiplexer and demultiplexer circuits, using knowledge, hand tools, materials, process sheet and schematic, to produce an operational assembly.

Achievement Indicators: The learner:	Yes	No
1. Obtained all materials required to complete the assembly -	____	____
2. Completed construction as outlined in the process sheet -	____	____
3. Completed visual inspection of assembly -	____	____
4. Recorded assembly documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Took Kit	Process Sheet, Schematic

Duty: Assembling Sub-Assemblies and Complete Units	**Duty No.** B
	Task No. 14

Task: Construct a digital central processing unit, using knowledge, process sheets, data sheets, schematics and hand tools, to produce an operational unit.

Achievement Indicators: The learner:

	Yes	No
1. Obtained all materials necessary to assemble unit -	____	____
2. Constructed unit in accordance with assembly sheet -	____	____
3. Performed visual inspection of completed unit -	____	____
4. Completed assembly documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Tool Kit	Assembly Process Sheets, Data Sheets, Schematic

Duty: Assembling Sub Assemblies and Complete Units	**Duty No.** B
	Task No. 15

Task: Interface an external timing signal, using hand tools and schematic, to synchronize the microprocessor.

Achievement Indicators: The learner:

	Yes	No
1. Obtained schematic, hand tools, components, and hardware -	____	____
2. Connected timing circuit -	____	____
3. Demonstrated a functional test to insure proper operation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Wire Wrapping Tool
Diagonal Cutters
Microprocessor

Resources:

Schematic

Duty: Assembling Sub Assemblies and Complete Units	**Duty No.** B
	Task No. 16

Task: Interface memory circuit to a microprocessor, using hand tools and schematics, to insure reliable operation.

Achievement Indicators: The learner:	Yes	No
1. Obtained schematic, hand tools, and components -	____	____
2. Connected memory circuit to microprocessor -	____	____
3. Demonstrated an elementary memory test to ensure proper operation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Diagonal Cutters
Long Nose Plier
Wire Wrapping Tool
Microprocessor

Resources:

Schematic

Duty: Assembling Sub Assemblies and Complete Units	**Duty No.** 8
	Task No. 17

Task: Interface an anolog-to-digital converter, using hand tools and schematic, to operate an input sensor with a microprocessor system.

Achievement Indicators: The learner:	Yes	No
1. Obtained schematic, hand tools, components, and hardware -	____	____
2. Performed interface wiring -	____	____
3. Completed operational check of system -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:**
Long Nose Pliers Diagonal Cutter Wire Wrapping Tool Screwdrivers Microprocessor	Schematic

Duty: Assembling Sub Assemblies and Complete Units	**Duty No.** B
	Task No. 18

Task: Interface an external data display, using hand tools and schematic, to operate a microprocessor.

Achievement Indicators: The learner:

	Yes	No
1. Obtained schematic, tools, components, and hardware -	____	____
2. Completed hardware hook-up -	____	____
3. Performed operational check of circuits -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:
Wire Wrapping Tool
Diagonal Cutters
Long Nose Pliers
Screwdrivers
Microprocessor
Display Unit

Resources:
Schematics

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 1

Task: Perform test/measurement of a resistor, using test equipment and appropriate measuring device and data sheets, to verify that the component meets the specifications.

Achievement Indicators: The learner:	Yes	No
1. Obtained specifications -	____	____
2. Performed visual inspection -	____	____
3. Performed mechanical measurement -	____	____
4. Read resistor value using color code -	____	____
5. Identified various types of resistors -	____	____
6. Performed resistance tolerance test -	____	____
7. Completed appropriate inspection/test documentation -	____	____
8. Observed safety practices during all phases of performance test -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Scale or Micrometer Ohmmeter or RCL Bridge Test Leads	Manufacturer's Specification Sheets Blueprint

Teacher Activities	Student Learning Activities
Review 1. How many of you have tested a resistor? 2. How many of you have tested a resistor to see if it is in tolerance? 3. How many of you have performed a mechanical measurement? 4. How many of you have referred to the data sheet? Overview 1. All components have a number of specifications they must meet. This is important to the company manufacturing them and their customers using them. The specification or data sheet sets the standards to which the components must conform. 2. This task will demonstrate how to perform the non-distructive testing of a resistor. Presentation 1. Discuss how the manufacturer lists the characteristics. 2. Demonstrate how to use the tables, charts and graphs, color code. 3. Discuss/demonstrate how and why components are reel packaged for use on an automatic assembly equipment. 4. Demonstrate a visual inspection. 5. Demonstrate the use of measuring devices (scale and/or micrometer) to measure resistor's dimensions. 6. Demonstrate how to measure resistance and tolerance. 7. Demonstrate how to identify type (carbon, wirewound, etc.). Exercise Have students practice skills using data sheets and making test/measurements.	Exercise 1. Attend discussion on industrial standards for components (resistors). 2. Attend demonstrations on use of data sheet and test equipment. 3. Practice skills by performing a given number of resistors to test. 4. Demonstrate proficiency by performing the task satisfactorily to an evaluator.

Teacher Activities	Student Learning Activities
Summary What is needed to perform the testing and measurement of resistors? Why is it important to document this testing? Evaluate students using achievement indicators.	

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 2

Task: Perform test/measurement of a resistor network, using proper measuring devices, data sheet and blueprint test equipment, to verify that the component meets the specifications.

Achievement Indicators: The learner:

	Yes	No
1. Obtained specifications -	____	____
2. Performed visual inspection -	____	____
3. Performed mechanical measurement -	____	____
4. Performed resistance test -	____	____
5. Completed appropriate inspection/test documentation -	____	____
6. Observed safety practices during all phases of performance test -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Scale or Micrometer Ohmmeter or RCL Bridge Test Leads	Manufacturer's Specification Sheet Blueprint

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 3

Task: Perform test/measurement of an inductor, using proper tools, test equipment, and specification data, to verify that the component meets the specifications.

Achievement Indicators: The learner:	Yes	No
1. Obtained specification data -	____	____
2. Performed visual inspection -	____	____
3. Performed mechanical measurement -	____	____
4. Performed resistive test -	____	____
5. Completed appropriate inspection/test documentation -	____	____
6. Observed safety practices during all phases of performance test -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Scale or Micrometer Ohmmeter or RCL Bridge Test Leads	Manufacturer's Specification Sheet Blueprint

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 4

Task: Perform test/measurement of a capacitor, using proper tools, test equipment, and specification data, to verify that the component meets the specifications.

Achievement Indicators: The learner:

	Yes	No
1. Obtained specification data -	____	____
2. Performed visual inspection -	____	____
3. Performed mechanical measurement -	____	____
4. Performed capacitive electrical test -	____	____
5. Completed appropriate inspection/test documentation -	____	____
6. Observed safety practices during all phases of performance test -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:
Scale or Micrometer
Capacitance Meter or RCL Bridge
Test Leads

Resources:
Manufacturer's Specification Sheets
Blueprint

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 5

Task: Perform test/measurement of a transformer, using proper tools, equipment, and specification data, to verify that the device meets the specifications.

Achievement Indicators: The learner:

	Yes	No
1. Obtained specification data -	____	____
2. Performed visual inspection -	____	____
3. Performed mechanical measurement -	____	____
4. Performed electrical test - no load* -	____	____
5. Performed electrical test - load conditions* -	____	____
6. Completed appropriate inspection/test documentation -	____	____
7. *Observed safety practices during all phases of performance test - Beware of electrical shock hazard from AC high voltage -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:

Scale
Ammeter
Voltmeter
Load Device
Screwdrivers
Nutdrivers
Test Leads

Resources:

Manufacturer's Specification Sheet
Blueprint

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 6

Task: Perform test/measurement of a Diode, using test equipment, appropriate measuring device and data sheet, to verify that the component meets the specifications.

Achievement Indicators: The learner:	Yes	No
1. Obtained data sheet -	____	____
2. Performed visual inspection -	____	____
3. Performed mechanical measurement -	____	____
4. Performed electrical test as specified -	____	____
5. Compared findings with specifications -	____	____
6. Completed documentation of findings -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Hook-up Leads Voltmeter Test Fixture Ammeter Scope (Curve Tracer) Scale Micrometer	Manufacturer's Specification Sheet

Duty: Testing Components, Assemblies, and Systems

Duty No. C

Task No. 7

Task: Test electronic function of assemblies, using test equipment, hand tools, and performance data sheets, to verify that the unit meets the specifications.

Achievement Indicators: The learner:

	Yes	No
1. Connected unit to test instruments -	____	____
2. Read instrument dial or scope -	____	____
3. Compared instrument readings with standard and rejected defected units -	____	____
4. Recorded type and quantity of defect -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Assorted Wrenches
Screwdrivers
Oscilloscope
LCR Bridge
Voltmeter
Ammeter
Ohmmeter Frequency Counter

Resources:

Data Sheet

Duty: Testing Components, Assemblies, and Systems

Duty No. C

Task No. 8

Task: Perform test of a power supply, using proper tools, fixtures, test equipment, and data sheet, to verify that the device meets the electrical specifications.

Achievement Indicators: The learner:

	Yes	No
1. Obtained specification sheet -	____	____
2. Performed visual inspection -	____	____
3. Connected hook-up wires -	____	____
4. Connected test equipment -	____	____
5. Positioned power supply for easy access to test fixture -	____	____
6. Performed electrical test - no load* -	____	____
7. Performed electrical test - load condition* -	____	____
8. Performed electrical test - various input voltages* -	____	____
9. Disconnected test/equipment and hook-up wires -	____	____
10. Compared findings with specifications -	____	____
11. Completed appropriate documentation -	____	____
12. *Observed safety practices during all phases of test - Potential shock hazard from AC high voltage -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Screwdrivers
Nutdrivers
Ammeter
Voltmeter
Test Fixture
Hook-Up Wire
Oscilloscope

Resources:

Specification Sheet

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 9

Task: Perform test/measurement of an amplifier, using proper hand tools, test equipment, and data sheet, to verify operational condition.

Achievement Indicators: The learner:	Yes	No
1. Obtained amplifier data sheet -	____	____
2. Performed visual inspection -	____	____
3. Connected amplifier to test equipment -	____	____
4. Performed electrical test -	____	____
5. Disconnected amplifier from test set-up -	____	____
6. Compared findings with specifications -	____	____
7. Completed documentation -	____	____
8. Observed safety practices during all phases of test -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Screwdrivers
Ammeter
Voltmeter
Watt Meter
Signal Generator
Hook-Up Leads

Resources:

Specification Data Sheet

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 10

Task: Perform functional test of a D.C. motor, using hand tools, test equipment, and data sheet, to verify operation.

Achievement Indicators: The learner:	Yes	No
1. Obtained data sheet -	____	____
2. Connected motor to test fixture -	____	____
3. Performed functional test		
a. Checked R.P.M.'s -	____	____
b. Checked direction of shaft rotation (C.W. or C.C.W.) -	____	____
c. Performance at rated input voltage -	____	____
d. Performance at rated current -	____	____
4. Compared findings to data sheet -	____	____
5. Disconnected test motor from fixture -	____	____
6. Recorded test data/report -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:
Assorted Wrenches
Screwdriver
D.C. Ammeter
D.C. Voltmeter
Tachometer
Motor Holding Fixture

Resources:
Motor Data Sheet/Plate

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 11

Task: Perform functional test of an A.C. motor, using hand tools, test equipment, and data sheet, to verify operation.

Achievement Indicators: The learner:	Yes	No
1. Obtained data sheet -	____	____
2. Connected motor to test fixture -	____	____
3. Performed functional test		
a. Checked R.P.M.'s -	____	____
b. Checked direction of shaft rotation (C.C.W. or C.W.) -	____	____
c. Performance at rated input volt/voltages -	____	____
d. Performance at rated current -	____	____
*4. Compared findings with data sheet -	____	____
5. Recorded test data/report -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:
Assorted Wrenches
Screwdrivers
A.C. Ammeter
A.C. Voltmeter
Tachometer
Motor Holding Fixture

Resources:
Motor Data Sheet/Plate

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 12

Task: Perform test/measurement of a clock and timing circuit, using knowledge, test equipment, data sheet and schematic, to verify that the circuit meets specifications.

Achievement Indicators: The learner:	Yes	No
1. Obtained all materials required to perform test -	____	____
2. Performed visual inspection of assembly -	____	____
3. Completed hook up of test equipment to assembly under test -	____	____
4. Completed hook up of power to assembly under test -	____	____
5. Completed frequency measurement -	____	____
6. Completed amplitude measurement -	____	____
7. Completed duty cycle measurement -	____	____
8. Completed pulse duration measurement -	____	____
9. Compared findings with data sheet -	____	____
10. Completed appropriate documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Voltmeter Logic Probe Oscilloscope Frequency/Period Counter Test Leads	Schematic, Data Sheet

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 13

Task: Perform test/measurement of a digital counter circuit, using knowledge, test equipment, schematic and data sheet, to verify that the circuit meets the specifications.

Achievement Indicators: The learner:	Yes	No
1. Obtained all materials required to perform test -	____	____
2. Performed visual inspection of assembly -	____	____
3. Completed hook up of test equipment to circuit under test -	____	____
4. Completed hook up of power to circuit under test -	____	____
5. Performed test/measurements with known input valves -	____	____
6. Performed test/measurement-of asynchronous inputs, set, clear, preset -	____	____
7. Compared findings with data sheet -	____	____
8. Completed appropriate documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:

Voltmeter
Logic Probe
Oscilloscope
Signal Generator
Test Leads

Resources:

Data Sheet, Schematic

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 14

Task: Perform test/measurement of a digital register circuit, using knowledge, test equipment, data sheet and schematic, to verify that the circuit meets the specifications.

Achievement Indicators: The learner:

	Yes	No
1. Obtained all materials necessary to perform test -	____	____
2. Performed visual inspection of an assembly -	____	____
3. Completed hook-up of test equipment to register under test -	____	____
4. Completed hook-up of power to register under test -	____	____
5. Performed test/measurements with known input valves -	____	____
6. Performed test/measurement of asynchronous inputs, set, clear, preset -	____	____
7. Compared findings with data sheet -	____	____
8. Completed appropriate documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:

Voltmeter
Logic Probe
Signal Generator
Oscilloscope
Test Leads

Resources:

Data Sheet, Schematic

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 15

Task: Perform test/measurement of encoder and decoder circuits, using knowledge, test equipment, data sheet and schematic, to verify that the circuit meets the specifications.

Achievement Indicators: The learner:	Yes	No
1. Obtained all materials necessary to test assembly -	____	____
2. Performed visual inspection of assembly -	____	____
3. Completed set up of test equipment to assembly -	____	____
4. Completed hook up of power to assembly -	____	____
5. Performed test/measurements with known input valves -	____	____
6. Compared input code with output code -	____	____
7. Compared input/output codes with data sheet -	____	____
8. Completed appropriate documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Voltmeter Logic Probe Oscilloscope Test Leads	Schematic, Data Sheet

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 16

Task: Perform test/measurement of multiplexer and demultiplexer circuits, using knowledge, test equipment, data sheet and schematic, to verify that the circuit meets the specifications.

Achievement Indicators: The learner:	Yes	No
1. Obtained all materials necessary to test assembly -	____	____
2. Performed visual inspection of assembly under test -	____	____
3. Completed set up of test equipment to assembly -	____	____
4. Completed hook up of power to assembly -	____	____
5. Performed test/measurement with known input valves -	____	____
6. Compared input code with output code -	____	____
7. Compared findings with data sheet and schematic -	____	____
8. Completed appropriate documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:

Voltmeter
Logic Probe
Oscilloscope
Test Leads

Resources:

Data Sheet, Schematic

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 17

Task: Develop a straight line program, using program instructions and microprocessor, to demonstrate program operation.

Achievement Indicators: The learner:	Yes	No
1. Obtained program instructions -	____	____
2. Loaded program -	____	____
3. Examined data stored -	____	____
4. Corrected any errors that were found - verified program execution -	____	____
5. Executed the program -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:**
Microprocessor	Program Instructions

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 18

Task: Develop a microprocessor program, using program instructions and microprocessor, to demonstrate the use of subroutines and gain experience writing programs.

Achievement Indicators:

The learner:	Yes	No
1. Obtained program instruction -	____	____
2. Wrote program using monitor subroutines -	____	____
3. Loaded program -	____	____
4. Verified program, debugged program (if required) -	____	____
5. Executed program -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:	**Resources:**
Microprocessor	Program Instructions

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 19

Task: Develop a microprocessor program, using program instructions, stack operations, and microprocessor, to demonstrate automatic functions.

Achievement Indicators: The learner:	Yes	No
1. Obtained instructions -	____	____
2. Verified program operation -	____	____
3. Demonstrated operations that occurred automatically -	____	____
4. Demonstrated uses of the stack operation -	____	____
5. Demonstrated use of interrupts -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:	**Resources:**
Microprocessor	Program Instructions

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 20

Task: Develop a microprocessor program, using software instructions and microprocessor, to verify program operation and debugging procedures.

Achievement Indicators: The learner:	Yes	No
1. Obtained program data -	____	____
2. Loaded program into microprocessor -	____	____
3. Manipulated code registers to determine conditions that set and reset flags -	____	____
4. Demonstrated conditional branch instructions -	____	____
5. Demonstrated the use of the microprocessor in debugging programs -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:	**Resources:**
Microprocessor	Program Instructions

Duty: Testing Components. Assemblies, and Systems	**Duty No.** C
	Task No. 21

Task: Develop a microprocessor program, using program instructions and microprocessor, to gain experience writing programs.

Achievement Indicators: The learner:	Yes	No
1. Obtained instructions -	____	____
2. Demonstrated a method of performing multiplication -	____	____
3. Demonstrated multiple - precision arithmetic -	____	____
4. Demonstrated an algorithm for finding the square root of a number -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:	**Resources:**
Microprocessor	Program Instructions

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 22

Task: Perform operational test of a digital display unit, using proper tools, fixtures, test equipment, assembly sheet, and schematics, to verify that the unit meets the specifications.

Achievement Indicators: The learner:	Yes	No
1. Obtained assembly sheets and schematic -	____	____
2. Performed visual inspection -	____	____
3. Connected test fixture to unit under test -	____	____
4. Performed electrical test as specified -	____	____
5. Compared findings with specifications -	____	____
6. Completed documentation of findings -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Screwdrivers
Hook-Up Leads
Test Fixture

Resources:

Assembly Data Sheet
Blueprint
Schematic

Duty: Testing Components, Assemblies, and Systems	**Duty No.** C
	Task No. 23

Task: Perform test/measurement of digital microprocessor central processing unit, using knowledge, data sheets, schematics, process sheets, and test equipment, to verify that the CPU meets the specifications.

Achievement Indicators: The learner:	Yes	No
1. Obtained all materials necessary to test unit -	____	____
2. Performed visual inspection of unit -	____	____
3. Completed set up of test equipment to unit -	____	____
4. Completed hook up of power to CPU -	____	____
5. Performed test/measurement of power supply voltages at CPU -	____	____
6. Performed test/measurement of control circuits -	____	____
7. Performed test/measurement of clock circuit -	____	____
8. Performed test/measurement of ALU circuits -	____	____
9. Performed test/measurement of CPU's registers -	____	____
10. Performed test/measurement of input/output ports -	____	____
11. Performed test/measurement of memory circuits -	____	____

Criteria: Competence in the task will be recgonized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:

Multimeter
Logic Probe
Oscilloscope
Frequency Counter
Test Leads

Resources:

Data Sheets, Schematic, Process Sheet
Manufacturer's Manual

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 1

Task: Clean equipment, using proper material, to remove contaminants that affect operation.

Achievement Indicators: The learner:	Yes	No
1. Deenergized system -	____	____
2. Removed cleaning activities -	____	____
3. Performed cleaning activities -	____	____
4. Removed - replaced/cleaned filters -	____	____
5. Installed access panels -	____	____
6. Energized system -	____	____
7. Tested for performance -	____	____
8. Completed records entry -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Screwdrivers
Wrenches
Assorted Cleaning Solution
Wiping Cloth (Low Pressure Air)
Extension Cord
Inspection Lamp
Safety Glasses

Resources:

Teacher Activities	Student Learning Activities
Review 1. How many of you have performed cleaning activities on shop equipment or equipment at home? 2. What type of cleaning material did you use? 3. Do you keep track of how many times a year you did this cleaning? Overview In industry, this is called "Preventive Maintenance". Performing preventive maintenance aids in keeping machines and equipment in good working order. It can also extend the equipment's working life. However, this requires the use of the proper cleaning materials and observing safety procedures while completing this task. Keeping maintenance records is part of good maintenance practices. Presentation 1. Discuss the different types of cleaning used and why. 2. Demonstrate/discuss the methods used in cleaning activities. 3. Discuss check of completed work to insure all access panels, filters have been replaced/reinstalled, etc. 4. Discuss why it may be necessary to run a performance test. 5. Discuss the requirement to document all maintenance performed. Exercise Have students perform task and document completed work. Summary Review types of cleaning materials and procedures. Evaluate students performing task satisfactorily to achievement indicators.	Exercise 1. Attend discussions on preventive maintenance. 2. Attend demonstration of cleaning activities. 3. Perform a given number of cleaning tasks. 4. Review types of materials to use and procedures. 5. Demonstrate the task satisfactorily to an evaluator.

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 2

Task: Clean/lubricate mechanical drive components, using accepted procedures and chemicals, to obtain normal operation.

Achievement Indicators: The learner:	Yes	No
1. Deenergized system -	____	____
2. Gained access to drive mechanism -	____	____
3. Cleaned gears and mechanism -	____	____
4. Lubricated as necessary -	____	____
5. Reinstalled covers and panels -	____	____
6. Operational checked system -	____	____
7. Completed records entry -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:
Assorted Screwdrivers
Wrenches
Wiping Cloth
Cleansing Material
Lubricant
Safety Glasses
Low Pressure Air

Resources:

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 3

Task: Clean/lubricate a motor, using accepted procedures and chemicals, to obtain normal operation.

Achievement Indicators: The learner:	Yes	No
1. Deenergized system -	____	____
2. Disconnected motor from system -	____	____
3. Removed housing to access bearing, etc. -	____	____
4. Performed cleaning activities -	____	____
5. Performed lubrication, as necessary -	____	____
6. Assembled housing, covers, etc. -	____	____
7. Operational checked motor -	____	____
8. Completed records entry -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:**

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 4

Task: Replace a light bulb, using appropriate equipment, to restore light bulbs.

Achievement Indicators: The learner:

	Yes	No
1. Referred to manufacturer's repair manual for correct procedure for replacing light bulbs -	____	____
2. Removed necessary components to gain access to light bulb -	____	____
3. Removed light bulb -	____	____
4. Cleaned light bulb socket -	____	____
5. Installed replacement light bulb -	____	____
6. Installed necessary components removed to gain access to bulb -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 5

Task: Replace a bulb socket, using appropriate equipment, to restore the bulb socket to operation.

Achievement Indicators: The learner:	Yes	No
1. Referred to manufacturer's repair manual for correct procedure to replace bulb socket -	____	____
2. Removed components necessary to gain access to bulb socket -	____	____
3. Removed light bulb socket and disconnected electrical leads -	____	____
4. Installed light bulb socket -	____	____
5. Reconnected electrical leads -	____	____
6. Installed components necessary to gain access to bulb socket -	____	____
7. Checked operation of replacement light socket -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 6

Task: Test switches, using appropriate equipment, to detect resistance outside manufacturer's specifications.

Achievement Indicators: The learner:	Yes	No
1. Referred to manufacturer's repair manual for correct procedure to test switches -	____	____
2. Performed continuity test with an ohmeter for testing switch out of machine -	____	____
3. Compared readings with specifications -	____	____
4. Replaced defective components -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 7

Task: Bypass a switch, using appropriate materials, to determine possible switch failure.

Achievement Indicators: The learner:	Yes	No
1. Listed personal safety rules -	____	____
2. Listed equipment safety rules -	____	____
3. Reviewed function and operation of a switch -	____	____
4. Jumped the switch and tested operation of circuit -	____	____
5. Determined reliability of switch -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 8

Task: Replace switches, using appropriate equipment, to restore the switch to operation.

Achievement Indicators: The learner:	Yes	No
1. Referred to manufacturer's repair manual for correct procedure to replace switches -	____	____
2. Disconnected electrical leads from switch -	____	____
3. Removed switch -	____	____
4. Installed replacement switch -	____	____
5. Connected electrical leads to replacement switch -	____	____
6. Tested operation of switch -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 9

Task: Calibrate unit, using hand tools, test equipment, and data sheet, to insure unit meets operational specifications.

Achievement Indicators: The learner:	Yes	No
1. Obtained data sheet -	____	____
2. Removed covers, to access adjustments -	____	____
3. Connected device to test equipment -	____	____
4. Compared findings with specifications -	____	____
5. Performed required adjustments -	____	____
6. Installed covers -	____	____
7. Completed records -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Assorted Screwdrivers
Nutdrivers
Wrenches
Oscilloscope
Signal Generator
Ammeter
Voltmeter
Frequency Counter

Resources:

Specification Data Sheet

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 10

Task: Adjust mechanical part(s), using hand tools, standard gauges, test fixtures, process sheets and blueprints, to insure that the part meets the operational specifications.

Achievement Indicators: The learner:	Yes	No
1. Obtained specifications -	____	____
2. Performed adjustment -	____	____
3. Performed operation check -	____	____
4. Completed appropriate documentation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:
Screwdrivers
Wrenches
Gauges
Test Fixture

Resources:
Blueprint
Process Sheet

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 11

Task: Diagnose cause of malfunction of motor control panel, using hand tools, multimeter and schematics, to obtain normal operation.

Achievement Indicators: The learner:	Yes	No
1. Obtained schematic and hand tools -	____	____
2. Performed visual inspection -	____	____
3. Performed electrical test -	____	____
4. Deenergized system -	____	____
5. Replaced faulty component -	____	____
6. Performed operational test -	____	____
7. Completed records entry -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Assorted Wrenches
Screwdrivers
Multimeter

Resources:

Schematic
Wiring Diagram

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 12

Task: Diagnose cause of malfunction, using test equipment, hand tools, and schematics, to replace defective component.

Achievement Indicators: The learner:	Yes	No
1. Tested device for specified functions -	____	____
2. Used test equipment to verify defect -	____	____
3. Analyzed test results to diagnose cause of malfunction -	____	____
4. Replaced defective component -	____	____
5. Performed operational test of unit -	____	____
6. Completed repair record/report -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:
Assorted Wrenches
Screwdrivers
Extraction - Insurtion Tool
Soldering Iron
Multimeter
Logic Probe
Oscope

Resources:
Schematic
Data Sheet

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 13

Task: Diagnose cause of malfunction, using test equipment, hand tools, service manuals, schematics, wiring diagrams, and blueprints, to replace defective module/printed circuit board.

Achievement Indicators: The learner:	Yes	No
1. Tested/operated unit for specified functioning -	____	____
2. Analyzed test results to diagnose cause of malfunction -	____	____
3. Replaced defective module/P.C. Board -	____	____
4. Performed functional test of unit -	____	____
5. Completed repair record/report -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:
Assorted Wrenches
Screwdrivers
Multimeter

Resources:
Service Manual
Schematic
Manufacturer's Data

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 14

Task: Service faulty equipment, using hand tools, test equipment, schematics, and service manual, to assure proper operation.

Achievement Indicators: The learner:	Yes	No
1. Set up test equipment to conduct performance tests -	____	____
2. Performed performance test -	____	____
3. Analyzed and interpreted test results -	____	____
4. Analyzed malfunctions in operational equipment -	____	____
5. Used oscilloscope, signal generator, ammeter, voltmeter, logic probe, and frequency counter to multimeter to locate defects -	____	____
6. Replaced defective components and wiring using hand tools and soldering iron -	____	____
7. Adjusted mechanical parts using hand tools and gauges to specifications -	____	____
8. Calibrated unit according to specifications -	____	____
9. Test operate unit for specified functioning -	____	____
10. Entered required information to complete records logs, and report forms -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:

Screwdrivers; Wrenches; Alignment Tools, Oscilloscope; Signal Generator; Ammeter; Voltmeter; Multimeter; Frequency Counter; Logic Probe; Alignment Gauges

Resources:

Service Manual
Schematic

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 15

Task: Diagnose cause of malfunction, using test equipment, hand tools, service manuals, and schematics, to repair defective motor.

Achievement Indicators: The learner:	Yes	No
1. Obtained handtools, test equipment and manuals -	____	____
2. Performed visual inspection -	____	____
3. Connected motor to test equipment -	____	____
4. Performed electrical test -	____	____
5. Compared findings with specifications -	____	____
6. Replaced/repaired defective component -	____	____
7. Assembled housing, covers, etc. -	____	____
8. Operation checked motor -	____	____
9. Completed records entry -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the guidelines.

Tools and Equipment:	**Resources:**

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 16

Task: Service transformer(s), using voltmeter and all necessary tools, to determine voltage output.

Achievement Indicators: The learner:

	Yes	No
1. Obtained wiring diagram -	____	____
2. Performed visual inspection of transformer and wiring -	____	____
3. Obtained input voltage with voltmeter -	____	____
4. Obtained output voltage with voltmeter -	____	____
5. Verified finding with service manual, wiring diagram -	____	____
6. Observed safety practices during servicing -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's manual.

Tools and Equipment:	**Resources:**
Voltmeter Tool Kit	Manufacturer's Manual

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 17

Task: Demonstrate the use of test meters, using selected test instruments, to determine values of electricity.

Achievement Indicators: The learner:

	Yes	No
1. Performed voltage measurements to verify input-output voltages to components and circuitry -	____	____
2. Performed current measurements to verify components and circuitry values -	____	____
3. Performed resistance measurements to verify circuitry values -	____	____
4. Removed and replaced defective components as required -	____	____
5. Observed safety procedures during all phases of servicing components -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturing specifications.

Tools and Equipment:
A.C./D.C. Voltmeter
A.C./D.C. Ammeters
Multimeter
Clamp-On Meter
Assorted Hand Tools

Resources:
Manufacturer's Specifications
Service Manual

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 18

Task: Service capacitor(s), using apropriate test meters, to determine the condition of the capacitors.

Achievement Indicators: The learner:	Yes	No
1. Performed visual inspection -	____	____
2. Performed voltage test at component's working voltage -	____	____
3. Performed leakage test -	____	____
4. Verified findings with manufacturer's specifications -	____	____
5. Removed and replaced defective components -	____	____
6. Observed safety procedures during all phases of servicing -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
A.C./D.C. Voltmeter Multimeter RCL Bridge	Manufacturer's Service Manual Manufacturer's Specifications

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 19

Task: Service relays/contactors, using necessary test instruments, to insure proper operation.

Achievement Indicators: The learner:	Yes	No
1. Performed visual inspection -	____	____
2. Checked for mechanical binding -	____	____
3. Completed coil resistance measurement -	____	____
4. Completed coil current measurement -	____	____
5. Completed pull-in and drop-out voltage checks -	____	____
6. Completed check for excessive voltage drop across contacts -	____	____
7. Performed overload tests -	____	____
8. Removed and replaced defective components as required -	____	____
9. Observed safety procedures during all phases of servicing -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
A.C./D.C. Voltmeter Multimeter	Manufacturer's Service Manual

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 20

Task: Service motor(s), using knowledge and all necessary tools, to determine condition of motor windings.

Achievement Indicators: The learner:

	Yes	No
1. Performed visual inspection for possible overheating and indications of solder-throwing -	____	____
2. Completed check of commutator for possible shorts between adjacent bars -	____	____
3. Measured windings for opens, shorts, or grounded -	____	____
4. Repaired or replaced defective components -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:

Assorted Wrenches
Screwdrivers
Multimeter
Megohmmeter

Resources:

Manufacturer's Service Manual

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 21

Task: Service controls, using knowledge and necessary tools, to determine operating conditions.

Achievement Indicators: The learner:	Yes	No
1. Obtained wiring diagram, logic and sequence graph (as required) -	____	____
2. Performed a visual inspection of the components and wiring -	____	____
3. Reviewed sequence of operation to verify control operation -	____	____
4. Performed adjustments as required -	____	____
5. Observed safety procedures during all phases of servicing -	____	____
6. Recorded actions taken in the service report/log -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Tool Kit Multimeter	Manufacturer's Manual

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 22

Task: Locate electrical symbols, using appropriate materials, to identify electrical parts on a schematic.

Achievement Indicators: The learner:	Yes	No
1. Reviewed the following symbols: switch S.P.S.T ; switch S P.D.T.; switch P.B.N.O.; switch P.B.N.C.; resistor; bulb neon, bulb incandescent; battery, cell; ground; coil iron core; transistor; wires crossing not connected; wires crossing connected; capacitor; diode; rectifier; fuse, plug ac -	____	____
2. Located the above parts using a schematic -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 23

Task: Replace instrument gauges, using appropriate equipment, to restore the instrument gauge to operation.

Achievement Indicators: The learner:	Yes	No
1. Referred to manufacturer's repair manual for correct procedure to replace instrument gauges -	____	____
2. Removed all components necessary to gain access to instrument gauges -	____	____
3. Disconnected electrical leads from gauge -	____	____
4. Removed gauge -	____	____
5. Installed replacement gauge -	____	____
6. Connected electrical leads to gauge -	____	____
7. Reinstalled all components necessary to gain access to gauges -	____	____
8. Checked operation of gauge -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Servicing Components, Assemblies, and Systems	**Duty No.** D
	Task No. 24

Task: Measure resistance of a circuit, using appropriate equipment, to compare to manufacturer's specifications.

Achievement Indicators: The learner:

	Yes	No
1. Listed personal safety rules -	____	____
2. Listed equipment safety rules -	____	____
3. Reviewed operation of an ohmmeter -	____	____
4. Selected appropriate scale -	____	____
5. Measured resistance of circuit -	____	____
6. Compared to manufacturer's specifications -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty:	Maintaining Hydraulic and Pneumatic Systems	Duty No. E
		Task No. 1

Task: Install pipes/tubes/hoses, using knowledge and hand tools, to complete a system hook up.

Achievement Indicators: The learner:	Yes	No
Pipes		
1. Checked pipe for tears and cracks -	____	____
2. Used suitable pipe compound that was insoluble with systems fluid -	____	____
3. Used correct pipe size and fittings to component part size -	____	____
4. Provided support to the line as required (in line components, etc.) -	____	____
Tubing		
1. Checked tubing for burrs -	____	____
2. Checked tube flare and fittings -	____	____
3. Checked tube bends for kinks, flattened bends, wrinkles -	____	____
4. Aligned tubing to center line of the fittings -	____	____
5. Provided support to the line as required -	____	____
Hose		
1. Checked hose diameter for correct size -	____	____
2. Checked hose length (no tension) -	____	____
3. Checked hose to insure it did not exceed the minimum bend radius -	____	____
4. Checked for proper fittings/seals -	____	____
5. Performed pressure/leakage test of system after installation -	____	____

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Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:

Assorted Wrenches
Assorted Screwdrivers
Flaring Tool
Pipe Compound

Resources:

Manufacturer's Manual

Teacher Activities	Student Learning Activities
Review 1. Ask the students, how many of them have installed or repaired plumbing in their home? 2. How many have replaced a radiator hose or gas line in their car? Overview Fluid power systems use piping, tubing, and hoses to interconnect the components of a system. It has been said that improper installation of piping, tubing, and fittings is possibly the leading cause of fluid power system failures. Presentation 1. This task deals with the installation of pipe, tubing and hoses, commonly referred to in hydraulics as conductors. The fittings are called connectors. 2. Discuss the three major conductors used. Show samples of each type. 3. Demonstrate how each type is installed, and tested for leaks. 4. Have students assist in hook up and testing. Exercise Have students practice task using test stands to check for leakage. Summary Review task, as which type was the most difficult, which the easiest. Point out, that with care and patience during installation, it is one of the best guarantees of a smoothly operating system. Evaluate students performing task.	Exercise 1. Attend discussion on pipes, tubes and hoses. 2. Attend demonstration on installing procedures. 3. Take part in demonstration. 4. Practice task to gain skills. 5. Review procedures and materials used for each type. 6. Demonstrate proficiency by performing the task satisfactorily to an evaluator.

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 2

Task: Check pressure relief valve, using knowledge and necessary tools, to insure proper operation.

Achievement Indicators: The learner:	Yes	No
1. Turned power off electrical system -	____	____
2. Disconnected piping and removed relief valve -	____	____
3. Removed acorn nut and unscrewed lock nut on adjusting screw -	____	____
4. Backed off on adjustment screw until pressure was off threads -	____	____
5. Removed cover and inspected the "O" ring, the spring, the valve piston and valve body -	____	____
6. Replaced defective components as required, reassembled valve -	____	____
7. Connected valve into system -	____	____
8. Ran pump and set pressure to desired PSI and locked adjusting screw -	____	____
9. Verified that pressure did not increase as the system was activated -	____	____
10. Shut system down -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
	Manufacturer's Manual

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 3

Task: Install flexible coupling between electric motor and hydraulic pump, using knowledge, hand tools and manufacturer's specifications, to obtain maximum efficiency.

Achievement Indicators: The learner:	Yes	No
1. Obtained all materials to perform task -	____	____
2. Selected coupling to suit shaft diameters of electric motor and hydraulic pump -	____	____
3. Installed coupling halves on shaft so that their faces are within 1/8 inch of each other -	____	____
4. Secured couplings to shaft by tightening set screws -	____	____
5. Shimmed motor and/or pump to obtain alignment of O.D.'s of coupling halves to specifications -	____	____
6. Completed assembly of coupling as necessary -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Shim Stock Allen Wrench Set Assorted Wrenches Straight Edge Dial Indicator/With Stand	Manufacturer's Manual Data Sheet

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 4

Task: Adjust the pressure on a hydraulic system, using knowledge, test instruments and necessary tools, to insure proper operation.

Achievement Indicators: The learner:	Yes	No
1. Turned power off the pump motor -	____	____
2. Removed acorn nut from the relief valve -	____	____
3. Loosened lock nut -	____	____
4. Backed the adjusting screw up until free (not all the way out) -	____	____
5. Closed the valve on the output side of the pump -	____	____
6. Started the pump drive motor, opened the valve to the gauge -	____	____
7. Adjusted setting to required pressure, tightened adjustment screw locknut -	____	____
8. Tested the amperage of the motor to see that it was at or below full load amperage -	____	____
9. Stopped motor -	____	____
10. Replaced acorn nut -	____	____
11. Shut down system -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 5

Task: Inspect/test a hydraulic in-line check valve, using knowledge, hand tools and manufacturer's manual, to confirm proper operation.

Achievement Indicators: The learner:	Yes	No
1. Disassembled check valve to reveal flow path -	____	____
2. Identified flow path and explained function of valve -	____	____
3. Disassembled all remaining parts -	____	____
4. Inspected parts for wear or damage -	____	____
5. Replaced defective parts as required -	____	____
6. Reassembled check valve -	____	____
7. Mounted on test stand and tested for proper operation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:
Assorted Screwdrivers
Assorted Wrenches
Test Stand

Resources:
Manufacturer's Manual

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 6

Task: Inspect/test a hydraulic relief valve, using knowledge, hand tools and manufacturer's manual, to confirm proper operation.

Achievement Indicators: The learner:	Yes	No
1. Disassembled to reveal flow path -	____	____
2. Identified flow path and explained function of valve -	____	____
3. Disassembled all remaining parts -	____	____
4. Inspected parts for wear or damage -	____	____
5. Replaced defective parts as required -	____	____
6. Reassembled relief valve -	____	____
7. Mounted on test stand and tested for proper operation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Assorted Screwdrivers Assorted Wrenches Test Stand	Manufacturer's Manual

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 7

Task: Inspect/test a hydraulic flow control valve, using knowledge, hand tools and manufacturer's manual, to confirm proper operation.

Achievement Indicators: The learner:	Yes	No
1. Disassembled to reveal flow path -	____	____
2. Identified flow path and explained function of valve -	____	____
3. Disassembled all remaining parts -	____	____
4. Inspected parts for wear or damage -	____	____
5. Replaced defective parts as required -	____	____
6. Reassembled flow control valve -	____	____
7. Mounted on test stand and tested for proper operation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Assorted Screwdrivers Assorted Wrenches Test Stand	Manufacturer's Manual

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 8

Task: Inspect/test rotating group of hydraulic vane pump, using knowledge, hand tools, and manufacturer's manual, to confirm operation specifications.

Achievement Indicators: The learner:	Yes	No
1. Removed pump cover -	____	____
2. Identified components of rotating group:		
a. rotor/shaft -	____	____
b. vanes -	____	____
c. pressure ring -	____	____
d. bearings -	____	____
3. Identified flow path of fluid -	____	____
4. Removed rotating group and inspected for wear patterns and/or unusual wear -	____	____
5. Replaced defective parts as required -	____	____
6. Reassembled rotating group -	____	____
7. Reinstalled pump cover -	____	____
8. Installed on test stand and tested for performance to specifications -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Allen Wrench Set Rubber Mallet Screwdrivers Test Stand	Manufacturer's Manual

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 9

Task: Inspect/test a hydraulic pressure reducing valve, using knowledge, hand tools and manufacturer's manual, to confirm proper pperation.

Achievement indicators: The learner:	Yes	No
1. Disassembled to reveal flow path -	____	____
2. Identified flow path and explained function of valve -	____	____
3. Disassembled all remaining parts -	____	____
4. Inspected parts for wear or damage -	____	____
5. Replaced defective parts as required -	____	____
6. Reassembled valve -	____	____
7. Mounted on test stand and tested for proper operation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**
Assorted Screwdrivers Assorted Wrenches Assorted Allen Wrenches Test Stand	Manufacturer's Manual

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 10

Task: Inspect/test a hydraulic four-way directional valve, using knowledge, hand tools and manufacturer's manual, to insure proper operation.

Achievement Indicators: The learner:	Yes	No
1. Removed solenoid assemblies -	____	____
2. Removed spool (with centering springs if used) -	____	____
3. Inspected for foreign material in valve -	____	____
4. Identified flow path with solenoid "A" energized -	____	____
5. Identified flow path with solenoid "B" energized -	____	____
6. Identified flow path with no power -	____	____
7. Installed spool -	____	____
8. Assembled solenoids to valve -	____	____
9. Mounted on test stand and tested for proper operation -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:
Screwdrivers
Allen Wrenches
Test Stand

Resources:
Manufacturer's Manual

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 11

Task: Install a flow control and/or speed control valve(s), using knowledge and necessary tools, to insure proper operation.

Achievement Indicators: The learner:	Yes	No
1. Closed valve shutting off system -	____	____
2. Opened bleed off valve to relieve pressure -	____	____
3. Disconnected piping from shaft end of piston -	____	____
4. Installed speed control valve so that the exhaust air from piston was metered -	____	____
5. Turned air back on to the system -	____	____
6. Activated the directional control valve -	____	____
7. Ran piston in and out as speed control adjustment was changed -	____	____
8. Locked speed control adjustment screw at desired speed -	____	____
9. Shut off system -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 12

Task: Replace a pneumatic pressure regulator, using knowledge, test instruments and necessary tools, to insure proper operation.

Achievement Indicators: The learner:	Yes	No
1. Closed hand valve -	____	____
2. Broke the union between the oiler and the machine to block off any pressure that might have been present -	____	____
3. Removed and replaced pressure regulator -	____	____
4. Completed hook-up connecting and tightening union halves -	____	____
5. Installed pressure gauge into regulator -	____	____
6. Loosened adjustment screw on regulator -	____	____
7. Turned air on system by opening hand valve -	____	____
8. Tightened regulator adjustment screw until gauge reading was set at desired value -	____	____
9. Ran pneumatic machine and read pressure gauge to insure that pressure remained at set value -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 13

Task: Replace a two-way valve (solenoid operated), using knowledge and necessary tools, to insure proper operation.

Achievement Indicators: The learner:	Yes	No
1. Disconnected electrical power from control circuit -	____	____
2. Closed valve to cut off air to system from supply line -	____	____
3. Removed pneumatic lines from valve -	____	____
4. Removed mounting fasteners -	____	____
5. Replaced and mounted new valve -	____	____
6. Connected pneumatic lines to valve -	____	____
7. Connected solenoid to its control circuit -	____	____
8. Opened valve to put air on the system -	____	____
9. Checked for air leaks -	____	____
10. Energized solenoid and checked blow-off -	____	____
11. De-energized circuit after check-out -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 14

Task: Replace a three-way valve (solenoid operated), using knowledge, test instruments and necessary tools, to insure proper operation.

Achievement Indicators: The learner:	Yes	No
1. Turned off power to the pump motor and control circuit (checked with a voltmeter) -	____	____
2. Disconnected solenoid wires and hydraulic lines from the valve -	____	____
3. Removed and replaced valve -	____	____
4. Reconnected solenoid wires and hydraulic lines to the valve -	____	____
5. Turned power on to verify system operation -	____	____
6. Checked for leaks -	____	____
7. Checked movement of piston -	____	____
8. De-energized solenoid and observed -	____	____
9. Shut down system after completing checks -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 15

Task: Replace a four-way valve (solenoid operated), using knowledge, test instruments and necessary tools, to maintain proper operation.

Achievement Indicators: The learner:	Yes	No
1. Checked to insure that power was off the control system -	____	____
2. Disconnected wires from solenoid valves and removed conduit from valve -	____	____
3. Broke pressure line to valve slowly to make sure there was no pressure on the line -	____	____
4. Removed all lines to the valve -	____	____
5. Removed and replaced valve -	____	____
6. Checked old valve fitting before installing in new valve -	____	____
7. Connected all lines to new valves -	____	____
8. Reinstalled conduit and wires to valves -	____	____
9. Ran pump motor and checked for leaks -	____	____
10. Checked piston movement -	____	____
11. Turned power off hydraulic system -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 16

Task: Replace a hydraulic pump, using knowledge and necessary tools, to insure proper operation.

Achievement Indicators: The learner:	Yes	No
1. Turned power off to pump motor and control circuit -	____	____
2. Disconnected pump intake and outlet -	____	____
3. Disconnected pump drive coupling -	____	____
4. Removed and replaced hydraulic pump -	____	____
5. Reconnected pump drive coupling -	____	____
6. Reconnected pump intake and outlet pipes -	____	____
7. Performed vibration check with system running -	____	____
8. Performed hydraulic pressure check on system (no leaks) -	____	____
9. Tested amperage of drive motor to insure nameplate rating was not exceeded -	____	____
10. Turned power off to pump motor and control circuit -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Maintaining Hydraulic and Pneumatic Systems	**Duty No.** E
	Task No. 17

Task: Check a hydraulic pressure regulator, using knowledge, test instruments and necessary tools, to insure proper operation.

Achievement Indicators: The learner:	Yes	No
1. Removed the power from the electrical system -	____	____
2. Removed acorn nut from pressure-reducing valve and unlocked locking nut -	____	____
3. Turned adjusting screw out until it turned freely -	____	____
4. Removed covers and inspected the conical spring, and spring supports, valve piston, ball spring, ball and valve seat -	____	____
5. Removed and inspected the compensating spring and needle -	____	____
6. Reassembled valve with the exception of the acorn nut -	____	____
7. Turned power on and started pump motor -	____	____
8. Set adjustment screw for desired pressure -	____	____
9. Locked adjustment screw in place -	____	____
10. Manually operated directional control valves to obtain piston movement -	____	____
11. Checked pressure gauge to see that pressure returned to the present value -	____	____
12. Turned power off -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the manufacturer's specifications.

Tools and Equipment:	**Resources:**

Duty: Using Employability Skills	**Duty No.** F
	Task No. 1

Task: Perform a self-assessment, using knowledge and information, to compile a list of personal attributes.

Achievement Indicators: The learner:

	Yes	No
1. Listed work-related accomplishments-	____	____
2. Listed non-work related accomplishments -	____	____
3. Identified skills and competency attainment -	____	____
4. Identified transferable (portable) skills -	____	____
5. Determined strengths and weaknesses -	____	____
6. Described job liabilities and the affect liabilities have on employment opportunities -	____	____
7. Developed a plan to overcome job liabilities -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:
Goodman, Jane, Judith Hoppin and Ronald Kent, "First Steps" in Opening Doors: A Practical Guide for Job Hunting. Continuum Center, Oakland University, 1984, pp. 7-14.

Duty: Using Employability Skills	**Duty No.** F
	Task No. 2

Task: Perform a self-assessment, using knowledge and information, to identify areas of work that will provide personal job satisfaction.

Achievement Indicators:

The learner	Yes	No
1. Listed personal job values -	____	____
2. Rated each job value -	____	____
3. Listed enjoyable activities/interests -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:	**Resources:** Ibid, pp. 16-20

Duty: Using Employability Skills	**Duty No.** F
	Task No. 3

Task: Perform a self-assessment, using knowledge and information, to determine methods to reduce levels of stress.

Achievement Indicators: The learner:

	Yes	No
1. Identified stages of grief that result in stress -	____	____
2. Identified factors that reduced levels of stress -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:

Ibid, pp. 21-23.

Duty: Using Employability Skills

Duty No. F

Task No. 4

Task: Compile an occupational profile, using reference materials, to determine the characteristics, requirements, and employment outlook of an occupation.

Achievement Indicators: The learner:

	Yes	No
1. Described:		
a. Main job duties	____	____
b. Places of employment -	____	____
c. Physical demands -	____	____
d. Working (environmental) conditions -	____	____
e. Educat onal requirements -	____	____
f. Wage and fringe benefit information -	____	____
g. Local, regional and national employment outlook -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:

Dictionary of Occupational Titles (D.O.T.).

Goodman, Jane, Judith Hoppin and Ronald Kent, "Making Decisions," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 27-34.

Michigan Occupational Information System (M.O.I.S.)

Duty: Using Employability Skills	**Duty No.** F
	Task No. 5

Task: Investigate non-wage job characteristics, using available resources, to identify significant job factors.

Achievement Indicators:

The learner	Yes	No
1. Listed and described:		
a. Union affiliation -	____	____
b. Apprenticeship opportunities -	____	____
c. Occupational hazards -	____	____
d. Shift requirements -	____	____

Criteria:
Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:
Dictionary of Occupational Titles (D.O.T.).
Goodman, Jane, Judith Hoppin and Rônald Kent, "Making Decisions," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 27-34.
Michigan Occupational Information System (M.O.I.S.)

Duty: Using Employability Skills	**Duty No.** F
	Task No. 6

Task: Develop goals, using knowledge, to determine career objective(s).

Achievement Indicators: The learner:

	Yes	No
1. Listed short-term goals	____	____
2. Listed long-term goals -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:
Ibid, pp. 30-31.

Duty: Using Employability Skills

Duty No. F

Task No. 7

Task: Perform a job search, using information, to identify employment opportunities.

Achievement Indicators: The learner:

	Yes	No
1. Determined geographic boundaries for job search -	____	____
2. Listed types of potential places of employment -	____	____
3. Developed a list of prime sources of information concerning opportunities for employment -- advertised and unadvertised -	____	____
4. Gathered information about advertised and unadvertised job openings -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:

Goodman, Jane, Judith Hoppin and Ronald Kent, "Planning the Campaign," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 37-47

Duty: Using Employability Skills | **Duty No.** F | **Task No.** 8

Task: Participate in an information interview, using knowledge and resources, to obtain information about a job from an employer.

Achievement Indicators:

The learner:	Yes	No
1. Identified a job within the area of occupational interest -	____	____
2. Prepared a list of organizations that employ people to perform the identified job -	____	____
3. Scheduled an interview appointment with an employer at one of the organizations -	____	____
4. Prepared a list of questions for the interview -	____	____
5. Conducted the interview -	____	____
6. Prepared a follow-up letter to mail, after the interview, to the employer		

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:

Goodman, Jane, Judith Hoppin and Ronald Kent, "Planning the Job Campaign," Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 44-45.

Duty: Using Employability Skills	**Duty No.** F
	Task No. 9

Task: Complete a social security form, using information, to apply for a social security number.

Achievement Indicators:

The learner:	Yes	No
1. Contacted appropriate office to secure form -	____	____
2. Followed instructions on form -	____	____
3. Filled in each space on the form with the correct information -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions

Tools and Equipment:	**Resources:** "Handling the Paperwork," Employability Skills Guide #6, MSU.

Duty: Using Employability Skills	**Duty No.** F
	Task No. 10

Task: Contact an employer, using a telephone, to pursue potential employment opportunities.

Achievement Indicators:

The learner:	Yes	NO
1. Greeted receptionist -	____	____
2. Identified self and reason for phone call -	____	____
3. Asked to speak to appropriate person -	____	____
4. Arranged, if necessary, a time to call back -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:

Goodman, Jane, Judith Hoppin, and Ronald Kent, "Communicating with Employers," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 54-57.

Duty: Using Employability Skills	**Duty No.** F
	Task No. 11

Task:
Complete a job application, using personal notes, to apply for employment.

Achievement Indicators:

The learner:	Yes	No
1. Followed the directions specified on the application form -	____	____
2. Filled in each space where applicable, with the correct information -	____	____
3. Used a pen or typewriter to fill in application information -	____	____
4. Filled out the application neatly -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:

Goodman, Jane, Judith Hoppin, and Ronald Kent, "Communicating with Employers," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University. 1984, pp. 61-64

Duty: Using Employability Skills | **Duty No.** F | **Task No.** 12

Task: Prepare a resume, using persoral information, to apply for a job.

Achievement Indicators:

The learner:	Yes	No
1. Listed name, address, and telephone number -	____	____
2. Identified career objective -	____	____
3. Listed work experiences	____	____
4. Described job-related experiences -	____	____
5. Provided information about education -	____	____
6. Listed military experience, if acquired -	____	____
7. Described home/community activities -	____	____
8. Listed membership in work-related organizations/ associations -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:

Goodman, Jane, Judith Hoppin, and Ronald Kent, "Communicating with Employers," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 58-59, 65-71.

Duty: Using Employability Skills	**Duty No.** F
	Task No. 13

Task: Write a letter, using personal notes, to apply for a position.

Achievement Indicators: The learner:	Yes	No
1. Included:		
a. Name, address, phone number -	____	____
b. Date -	____	____
c. Name, title, firm, address of person to whom the letter is being sent -	____	____
d. Salutation -	____	____
2. Indicated, in paragraph one:		
a. An awareness of the business -	____	____
b. A reference to an ability/skill that will benefit the company -	____	____
3. Emphasized experience, abilities, accomplishments, in paragraph two -	____	____
4. Identified strengths/special training in paragraph three -	____	____
5. Included a follow-up plan in paragraph four -	____	____
6. Included complimentary closing -	____	____
7. Signed letter -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:

Goodman, Jane, Judith Hoppin and Ronald Kent, "Communicating with Employers," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 72-73.

Duty: Using Employability Skills	**Duty No.** F
	Task No. 14

Task: Demonstrate appropriate dress, using a knowledge of job requirements, to comply with standards of on-the-job attire and grooming.

Achievement Indicators: The learner:	Yes	No
1. Described and/or dressed in the attire of the appropriate occupational area, including:		
a. Grooming -	____	____
b. Health and safety equipment -	____	____
c. Uniforms -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:

Goodman, Jane, Judith Hoppin and Ronald Kent, "The Job Interview," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 77-96.

Duty: Using Employability Skills	**Duty No.** F
	Task No. 15

Task: Interview for a job, using communication skills, to secure employment.

Achievement Indicators: The learner:

	Yes	No
1. Demonstrated appropriate characteristics for job applicants including:		
a. Attire -	____	____
b. Grooming -	____	____
c. Conduct -	____	____
2. Demonstrated correct usage of interviewing techniques -	____	____
3. Prepared a list of questions to ask the interviewer(s) -	____	____
4. Prepared a follow-up letter to mail, after the interview, to the interviewer -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:

Goodman, Jane, Judith Hopoin and Ronald Kent, "The Job Interview," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 77-96.

Duty: Using Employability Skills	**Duty No.** F
	Task No. 16

Task: Contact a job interviewer, using a telephone, to accept/reject a job.

Achievement Indicators: The learner:	Yes	No
1. Spoke with interviewer who offered the job -	____	____
2. Identified self -	____	____
3. Accepted offer, if applicable -	____	____
4. Found out starting date and time, if appropriate -	____	____
5. Rejected offer courteously and politely, if applicable -	____	____
6. Gave reason for rejection, if applicable -	____	____
7. Concluded conversation correctly -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructor.

Tools and Equipment:	**Resources:**
	"Getting the Job," Employability Skills Guide #9, MSU. Ibid, pp. 77-96

Duty: Using Employability Skills	**Duty No.** F
	Task No. 17

Task: Complete forms, using information, to withhold city, state, and federal taxes.

Achievement Indicators: The learner:	Yes	No
1. Completed city tax form correctly -	____	____
2. Completed state tax form correctly -	____	____
3. Completed federal tax form correctly -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:	**Resources:**

Duty: Using Employability Skills	**Duty No.** F
	Task No. 18

Task: Describe performance evaluation measurements, using knowledge, to identify behavior/attitudes that employers expect employees to exhibit on-the-job.

Achievement Indicators: The learner:	Yes	No
1. Listed and described the methods to achieve successful working relationships -	____	____
2. Listed and defined importance of:		
a. Reliability -	____	____
b. Punctuality -	____	____
c. Quality -	____	____
d. Quantity -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:	**Resources:**
	Goodman, Jane, Judith Hopoin and Ronald Kent, "Opening the Door to Your Future," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 99-100.

Duty: Using Employability Skills	**Duty No.** F
	Task No. 19

Task: Perform a continuing education program search, using available resources, to identify opportunities for retraining, skills upgrading, and career advancement.

Achievement Indicators: The learner:	Yes	No
1. Described types and sources of continuing education programs for an occupation -	____	____
2. Related information to career alternatives -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:

Resources:

Goodman, Jane, Judith Hoopin and Ronald Kent, "Opening the Door to Your Future," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, P. 101.

Duty: Using Employability Skills	**Duty No.** F
	Task No. 20

Task: Analyze career information, using available resources, to identify the opportunities for advancement that exist within an occupation.

Achievement Indicators: The learner:

	Yes	No
1. Described the career stages associated with the occupational area:		
a. Listed jobs, entry through advanced levels -	____	____
b. Gave examples of tasks that employees in the occupation are required to perform -	____	____
c. Identified tools/equipment that employees in the occupation use -	____	____
d. Made reference to the relationship of the job(s) to data, people, things -	____	____
e. Made reference to education and/or on-the-job training needed to attain career mobility -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to instructions.

Tools and Equipment:

Resources:

Dictionary of Occupational Titles (D.O.T.).

Goodman, Jane, Judith Hoppin and Ronald Kent, "Opening the Door to Your Future," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 99-102.

Michigan Occupational Information System (M.O.I.S.)

Duty: Using Employability Skills	**Duty No.** F
	Task No. 21

Task: Describe job resignation/dismissal practice, using knowledge, to identify positive methods for terminating an employment situation.

Achievement Indicators: The learner:	Yes	No
1. Described practices for resigning from a job:		
a. Gave two weeks to a months notice -	____	____
b. Specified a positive reason for leaving the employment situation -	____	____
2. Described practices for job dismissal (laid off, released):		
a. Asked the employer for a letter of reference, if laid off -	____	____
b. Talked with the employer to discover what was the problem, if released -	____	____

Criteria: Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

Tools and Equipment:	**Resources:** "Knowing the Score," Employability Skills, Guide #10, MSU.

TOOL/EQUIPMENT LIST
FOR
INDUSTRIAL ELECTRONICS

2 STUDENTS PER WORK STATION

UNDER $300	DUTY
Frequency counter*	A - D
Digital multimeter*	A - E
Analog multimeter*	A - E
Function generator*	A - D
Logic probe*	A - D
Logic pulser*	A - D
Digital trainer*	A - D
2 A.C. voltmeters	C - E
2 D.C. voltmeters	C - E
Tool kits:*	A - E
Assorted screwdrivers	
Assorted nutdrivers	
Assorted wrenches	
Assorted Allen wrenches	
Long nose pliers	
Diagonal cutters	
Wirewrapping tool	
Exacto knife	
I.C. extractor/insertion tool	
Slip-joint pliers	
6 inch rule	
Desoldering tool	
Solder aid kit	
Soldering iron	
Soldering iron stand	
2 6 inch calipers	A, C
2 0-1 inch micrometers	A, C
2 Dip pliers	A - E
2 Crimping tool	A - E
2 Heat gun	A - E
2 Clamp-on ammeter	A - E

	UNDER $300 (continued)	DUTY
	Variable transformer*	A - D
	Isolation transformer	A - D
2	A.C. ammeter	C - E
2	D.C. ammeter	C - E
1	Tachometer	C - E
1	Drill press (safety glasses as required)	A - E
1	Bench grinder (safety glasses as required)	A - E
1	First aid kit (fire extinguisher as required)	A - E
	OVER $300	
1	D.C. motor tester	C - E
1	A.C. motor tester	C - E
1	Servo-motor tester	C - E
2	Programmable controller	C - E
	Microprocessor trainer*	A - D
	Oscilloscope - dual trace 30 Meg. Hz*	A - E
2	R-C-L bridge tester	A - C
	D.C. power supply*	C - D
1	Stepper motor tester	C - E

EQUIPMENT LIST FOR HYDRAULIC-PNEUMATIC-ROBOTICS

	OVER $300	
2	Hydraulics trainer	E
2	Pneumatics trainer	E
1	Servo systems trainer	C - E
1	Programmable controls trainer	C - E
1	Servo robotic trainer	E
1	Non-servo robotic trainer	E
2	Hydraulic component assembly/test bench	E
2	Hydraulic tear down bench (drain type)	E
2	Pneumatic component assembly/test bench	E
1	Shop tool set	E

* 1 each per work station

STUDENT ACHIEVEMENT RECORD

INDUSTRIAL ELECTRONICS

STUDENT _____

INSTRUCTIONS:

Mark each student's level of competence according to the following guide:

LEVEL	GUIDE
1	Student has been exposed to task
2	Task accomplished with assistance
3	Task accomplished to criteria by student
4	Ability to teach or demonstrate the task to others

TASK	LEVEL	DATE
A. PERFORMING RELATED ELECTRONICS ACTIVITIES		
1. Identify a resistor's value.		
2. Identify an inductor.		
3. Identify a transformer.		
4. Identify a capacitor.		
5. Identify a fuse.		
6. Identify a potentiometer.		
7. Identify a diode.		
8. Identify a transistor.		
9. Identify an integrated circuit.		
10. Draw a schematic diagram.		
11. Identify component and electrical terms.		
12. Demonstrate proper techniques.		
13. Analyze and measure basic circuits.		
14. Perform measurement of AC signals.		
15. Analyze and measure RC and RL time constants.		

TASK	LEVEL	DATE
A. PERFORMING RELATED ELECTRONICS ACTIVITIES (continued)		
16. Analyze digital logic gates.		
17. Analyze flip-flops.		
18. Analyze a digital microprocessor's central processing units (CPU).		
19. Perform soldering of components and wires.		
20. Prepare a parts list for prototype/production equipment.		
21. Write a summary report.		
B. ASSEMBLING SUB-ASSEMBLIES AND COMPLETE UNITS		
1. Install components on a circuit board.		
2. Install component parts on a chassis/panel.		
3. Construct wireharness.		
4. Route and attach wires and connectors.		
5. Connect assembly with power sources.		
6. Connect motor and control devices.		
7. Construct a power supply.		
8. Construct an amplifier.		
9. Construct a digital display unit.		
10. Assemble prototype system.		
11. Construct a clock and timing circuit.		
12. Construct a digital counter circuit.		
13. Construct a digital register.		
14. Construct encoder and decoder circuits.		
15. Construct multiplexer and demultiplexer.		
16. Construct a digital central processing unit.		
17. Construct a digital central processing unit.		
18. Interface an external timing signal.		
19. Interface memory circuit to a microprocessor.		
20. Interface an anolog-to-digital converter.		
21. Interface an external data display.		

TASK	LEVEL	DATE
C. TESTING COMPONENTS, ASSEMBLIES, AND SYSTEMS		
1. Perform test/measurement of a resistor		
2. Perform test/measurement of a resistor network.		
3. Perform test/measurement of an inductor.		
4. Perform test/measurement of a capacitor.		
5. Perform test/measurement of a transformer.		
6. Perform test/measurement of a diode.		
7. Test electronic function of assemblies.		
8. Perform test of a power supply.		
9. Perform test/measurement of an amplifier.		
10. Perform functional test of a D.C. motor.		
11. Perform function test of an A.C. motor.		
12. Perform test/measurement of a clock and timing circuit.		
13. Perform test/measurement of a digital counter circuit.		
14. Perform test/measurement of a digital register circuit.		
15. Perform test/measurement of encoder and decoder circuits.		
16. Perform test/measurement of a multiplexer and demultiplexer.		
17. Develop a straight line program.		
18. Develop a microprocessor program to demonstrate the use of subroutines and gain experience writing programs.		
19. Develop a microprocessor program to demonstrate automatic functions.		
20. Develop a microprocessor program to verify program operation and debugging procedures.		
21. Develop a microprocessor program to gain experience writing programs.		
22. Test/adjust prototype.		
23. Perform operational test of a digital display unit.		
24. Perform test/measurement of a digital microprocessor central processing unit.		

TASK	LEVEL	DATE
D. SERVICING COMPONENTS, ASSEMBLIES, AND SYSTEMS		
1. Clean equipment.		
2. Clean/lubricate mechanical drive components.		
3. Clean/lubricate motor.		
4. Replace a light bulb.		
5. Replace a bulb socket.		
6. Test switches.		
7. Replace switches.		
8. Calibrate unit.		
9. Adjust mechanical part(s).		
10. Diagnose cause of malfunction of motor control panel.		
11. Diagnose cause of malfunction to replace defective component.		
12. Diagnose cause of malfunction to replace defective module/printed circuit board.		
13. Service faulty equipment.		
14. Diagnose cause of malfunction to repair defective motor.		
15. Service transformer(s).		
16. Demonstrate the use of test meters.		
17. Service capacitor(s).		
18. Service relays/contactors.		
19. Service motor(s)		
20. Service controls.		
21. Solve equations involving Ohm's Law.		
22. Locate electrical symbols.		
23. Locate series circuit.		
24. Locate parallel circuit.		
25. Construct a circuit with an ammeter.		
26. Bypass a switch.		
27. Replace instrument gauges.		
28. Measure resistance of a circuit.		

TASK	LEVEL	DATE
E. MAINTAINING HYDRAULIC AND PNEUMATIC SYSTEMS		
1. Install pipes/tubes/hoses.		
2. Check pressure relief valve.		
3. Install flexible coupling between electric motor and hydraulic pump.		
4. Adjust the pressure on a hydraulic system.		
5. Inspect/test a hydraulic in-line check valve.		
6. Inspect/test a hydraulic relief valve.		
7. Inspect/test a hydraulic flow control valve.		
8. Inspect/test rotating group of hydraulic vane pump.		
9. Inspect/test a hydraulic pressure reducing valve.		
10. Inspect/test a hydraulic four-way directional valve.		
11. Install a flow control and/or speed control valve(s).		
12. Replace a pneumatic pressure regulator.		
13. Replace a two-way valve (solenoid operated).		
14. Replace a three-way valve (solenoid operated).		
15. Replace a four-way valve (solenoid operated).		
16. Replace a hydraulic pump.		
17. Check a hydraulic pressure regulator.		
F. USING EMPLOYABILITY SKILLS		
1. Perform a self-assessment to compile a list of personal attributes.		
2. Perform a self-assessment to identify areas of work that will provide personal job satisfaction.		
3. Perform a self-assessment to determine methods to reduce levels of stress.		
4. Compile an occupational profile.		
5. Investigate non-wage job characteristics.		
6. Develop goals.		
7. Perform a job search.		
8. Participate in an information interview.		
9. Complete a social security form.		
10. Contact an employer.		

TASK	LEVEL	DATE
F. USING EMPLOYABILITY SKILLS		
11. Complete a job application.		
12. Prepare a resume.		
13. Write a letter to apply for a position.		
14. Demonstrate appropriate dress.		
15. Interview for a job.		
16. Contact a job interviewer.		
17. Complete forms to withhold city, state and federal taxes.		
18. Describe performance evaluation measurements.		
19. Perform a continuing education program search.		
20. Analyze career information.		
21. Describe job resignation/dismissal practice.		

RESOURCE LIST

Bibliography

Alerich, Walter N. Electricity 3 - DC Motors and Generators, Controls, Transformers. Delmar Publishers, 1981.

Alerich, Walter N. Electricity 4 - AC Motors, Controls, Alternators. Delmar Publishers, 1981.

Baer, Charles J. and John R. Ottaway. Electrical and Electronics Drawing. McGraw-Hill, 1980.

DeGullmo, Joseph M., P.E. Electricity/Electronics: Principles and Applications. Delmar Publishers, 1982.

Driscoll, Edward F. Industrial Electronics Devices, Circuits and Applications. American Technical Publishers, Inc., 1976.

Gilmore, Charles M. Introduction to Microprocessors. McGraw-Hill, 1981.

Rockis, Gary and Glen Mazur. Electrical Motor Controls. American Technical Publishers, Inc., 1982.

Tokheim, Roger L. Digital Electronics. McGraw-Hill, 1979.

Zbar, Paul B. Industrial Electronics. McGraw-Hill, 1981.

Audio-Visual Aids

Library Film Strip Center

1. Electricity: A Happening
2. Electrical Safety in the Shop
3. Electronics: Safety for the Technician
4. Electronics: Wire and Conductors and Mechanical Connectors
5. Electronics: Soldering, Introduction
6. Electronics Soldering: Margin of Acceptability
7. Electronics Soldering: Printed Circuit
8. Electronics Soldering: Wire Joints and Terminals
9. Die Bonding
10. Macro and Micro Bonding
11. Micro Wire Bonding

Reference Materials

American Technical Publishers, Inc. Textbook Catalog. Algip, Illinois.

Bergwall Productions. Audio-Visuals. Garden City, New York.

Bishop Graphics, Inc. Graphics Materials. Westlake Village, California.

CLASS ACHIEVEMENT RECORD

| NAME | TASK No. | | |

Reference Materials (continued)

Charles E. Merrill Publishing Company. Textbook Catalog. Columbus, Ohio.

Commline. Journals of Computerized Manufacturing. Wheeling, Illinois.

Delmar Publishers, Inc. Textbook Catalog. Albany, New York.

Gregg/McGraw-Hill. Textbook Catalog. Manchester, Missouri.

Howard and Smith, Inc. Textbook and Audio-Visual Aids. Royal Oak, Michigan.

McGraw-Hill, Inc. Journals. Clinton, Iowa.

Robotics Institute, Journals. Dearborn, Michigan.

Society of Manufacturing Engineers. Journals. Dearborn, Michigan.

South-Western Publishing Company. Textbook Catalog. Cincinnati, Ohio.

Teaching Aids Incorporated. Audio-Visual Aids. Costa Mesa, California.

Vocational Filmstrip Company. Audio-Visual Aids and Film Strips. Wichita, Kansas.